Overview of the Climate Prediction Center with Emphasis on Drought Products

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Climate Prediction Center / NCEP

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Outline

- CPC Mission and Activities
- CPC Seasonal Climate (P&T) Outlooks
  - *What is CPC currently doing?*
- CPC Drought Information Products
  - *What is CPC currently doing?*
- How is CPC incorporating users of climate outlook information?
- Opportunities for enhanced collaboration with RGB
- Extras
  - *Proposed Changes to CPC US Seasonal Drought Outlooks*
  - *Climate Modeling and Prediction Advances at NCEP*

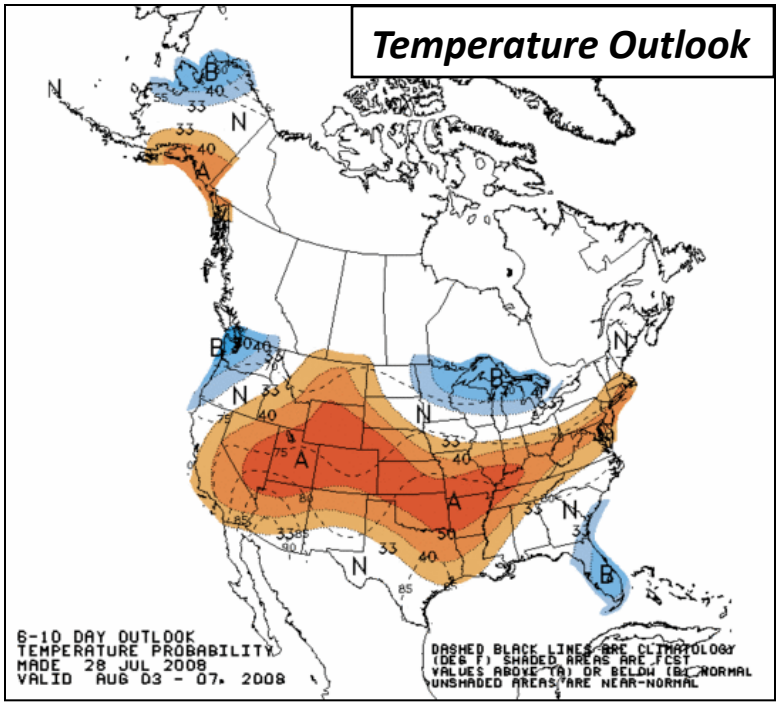
CPC Mission

We deliver climate prediction, monitoring, and diagnostic products for timescales from weeks to years to the Nation and the global community for the protection of life and property and the enhancement of the economy.

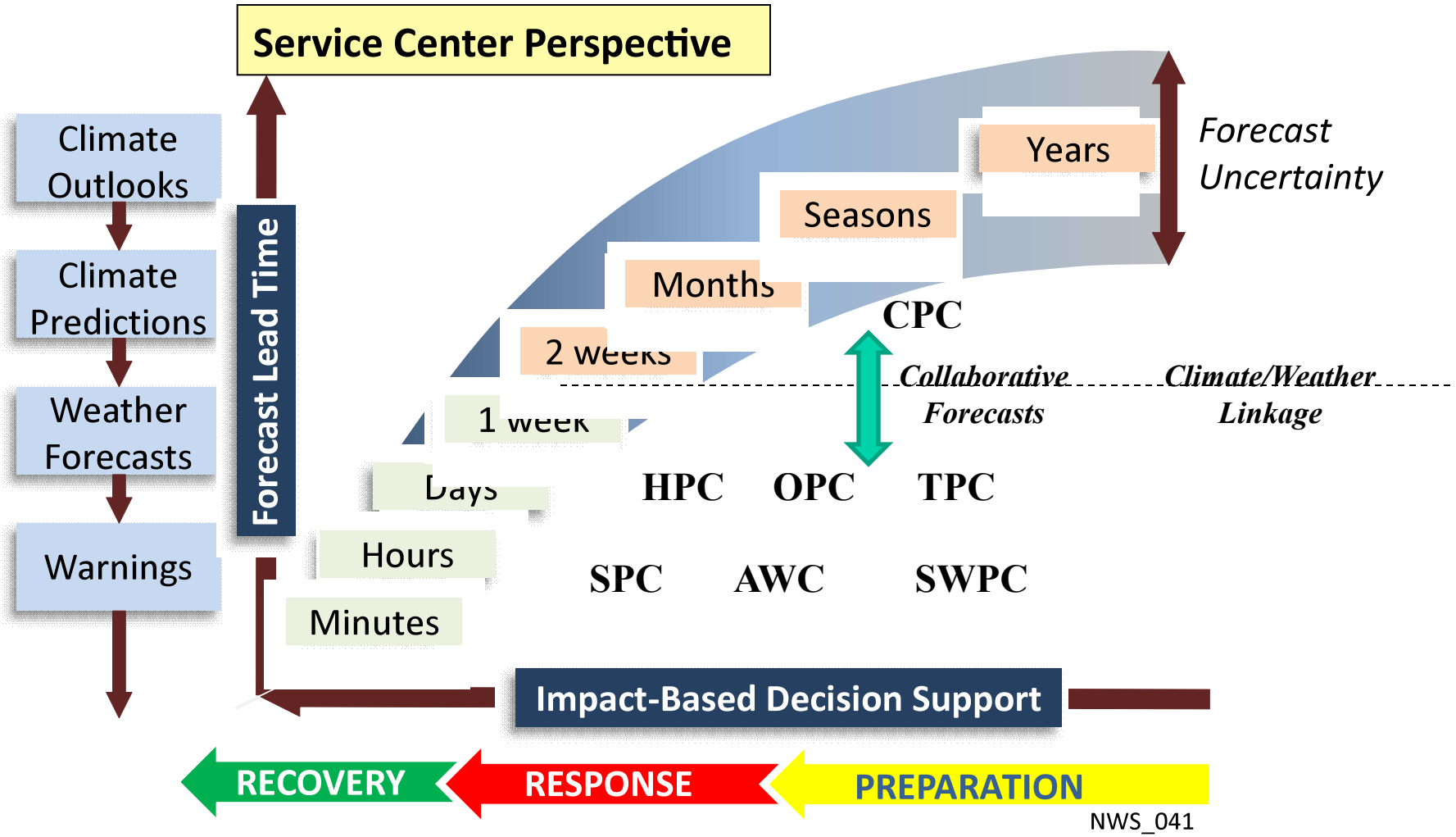
Operational Requirements:

- **Deliver national outlook products: temperature, precipitation, drought, hurricanes,..**
- **Span weeks, months, seasons, years**
- **Embrace collaborative forecasting with other NCEP Service Centers, NOAA line offices, other agencies and labs**
- **Ensure real-time, on-time, all the time (since '79)**
- **Enable NGSP Societal Challenges: "Water" and "Extremes"**

Temperature Outlook



NOAA Seamless Suite of Forecast Products Spanning Climate and Weather



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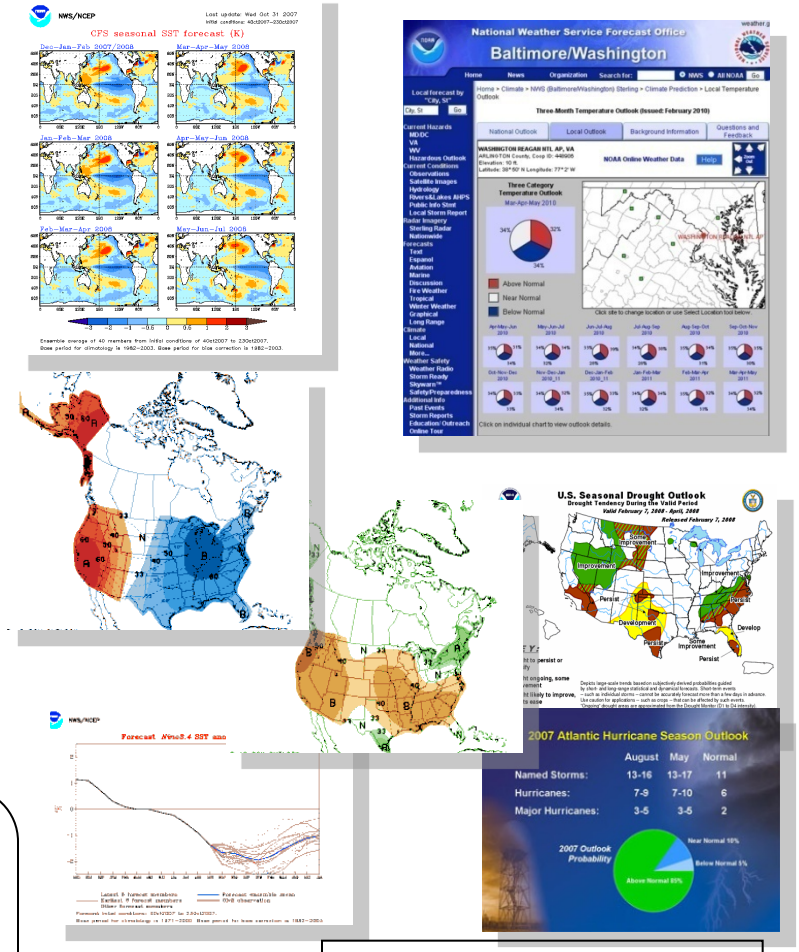
CPC Climate Prediction Products

- **Official Outlooks focused on week-2, monthly, seasonal**
  - 6-10 Day & 8-14 Day Precipitation & Temperature Outlooks
  - Day 3-14 Hazards Outlooks (US, Global Tropics)
  - Monthly & Seasonal Precipitation & Temperature Outlooks
  - Seasonal Drought Outlook
  - Seasonal Hurricane Outlooks (Atlantic and Eastern Pacific)
  - Monthly ENSO Prediction

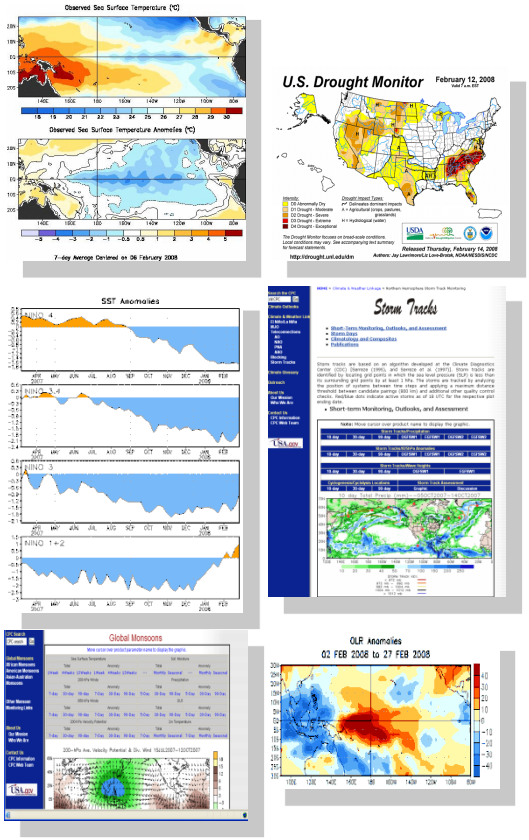


Tools used to develop prediction products
- Dynamical Models
- Statistical Models
- Historical Analogs
- Historical Composites

* <u>Dynamical Models</u>
- Climate Forecast System
- Global Forecast System
- ECMWF

CPC Climate Monitoring Products

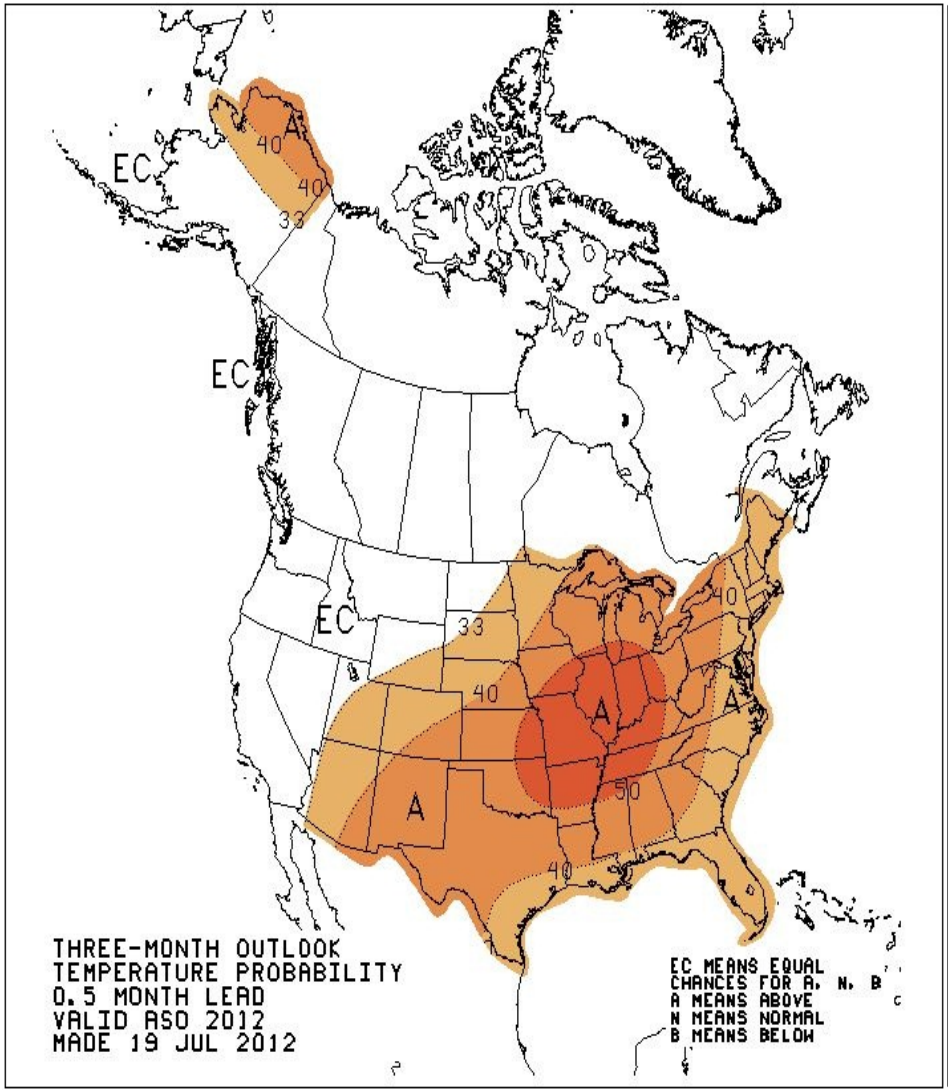
- **Monitor atmospheric, oceanic and land surface conditions using daily and monthly data, time series, and spatial maps (both real-time and historical)**
  - **Primary modes of climate variability (ENSO, MJO, NAO, PNA, AO,...)**
  - **Storm Tracks and Blocking**
  - **Monsoons**
  - **Precipitation and Surface Temperature**
  - **Drought (US, North America; NIDIS)**
- **Products rely on a wide range of real-time reanalyses (R1, R2, CFSR, NARR, GODAS)**

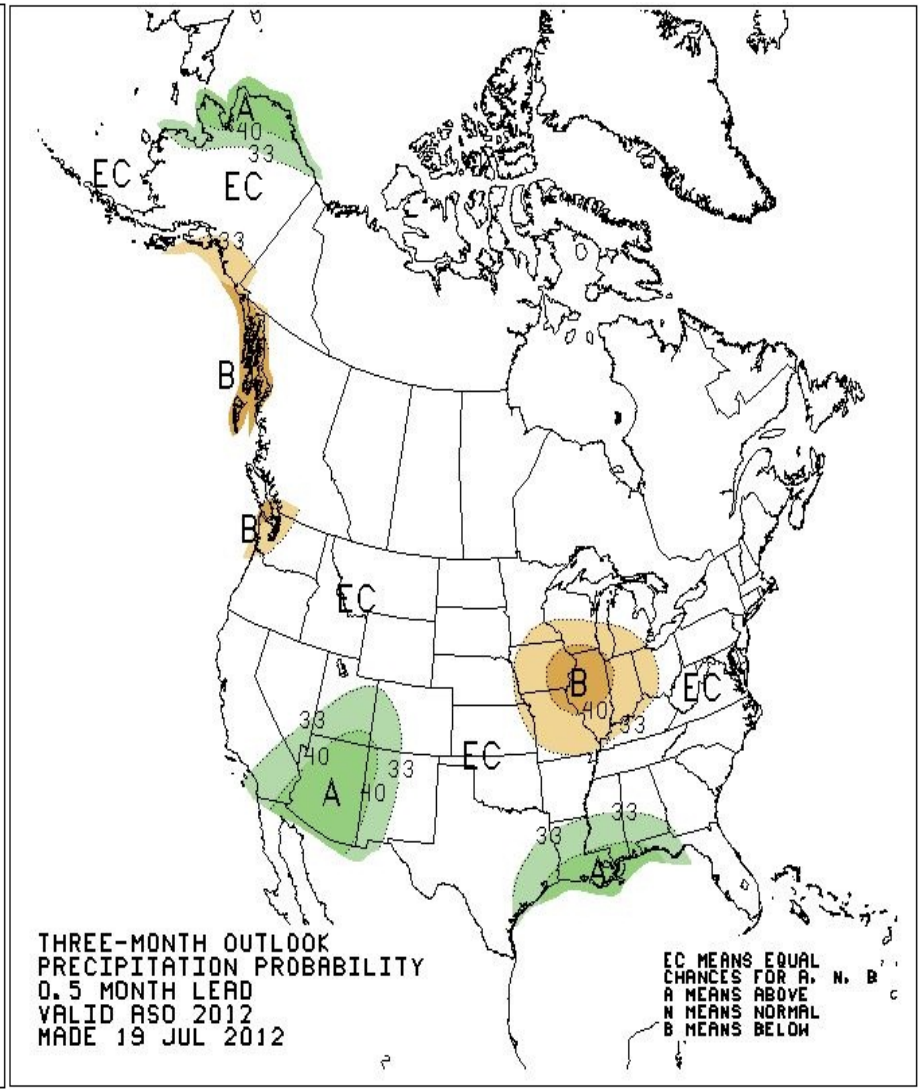


CPC Climate Diagnostic Products

- **Synthesis of current weather and climate information and forecasts; issued on a routine basis**
  - **Climate Diagnostics Bulletin (monthly, web)**
  - **ENSO Diagnostics Discussion (monthly, PDF and WORD)**
  - **Weekly ENSO / MJO / Monsoon / Ocean updates (.ppt, PDF, web)**
  - **Monthly Drought Briefing (nowcast and forecasts)**
  - **Seasonal Climate Summaries (web)**
  - **Special Climate Assessments (extreme events, web)**
  - **Annual Climate Assessment (multi-agency; published in the AMS Bulletin)**

CPC Seasonal Climate Outlooks





How Does CPC Make Operational Seasonal Climate Outlooks?

- Seasonal temperature and precipitation forecasts are based on a combination of statistical and dynamical forecasts
- An objective consolidation of forecast information provides a basis for a single outlook map
- A forecaster subjectively adjusts the forecast
- A team of seasonal forecasters reviews the forecasts with input from across NOAA and other agencies
  - First conference call on Friday before release date to review the current climate state and previous forecasts
  - Second call on Tuesday before release date to review the forecaster's preliminary maps
- Release date every third Thursday of the month

CPC Seasonal Climate Outlooks: Assorted Issues

Which tools are used…

How are tools combined?

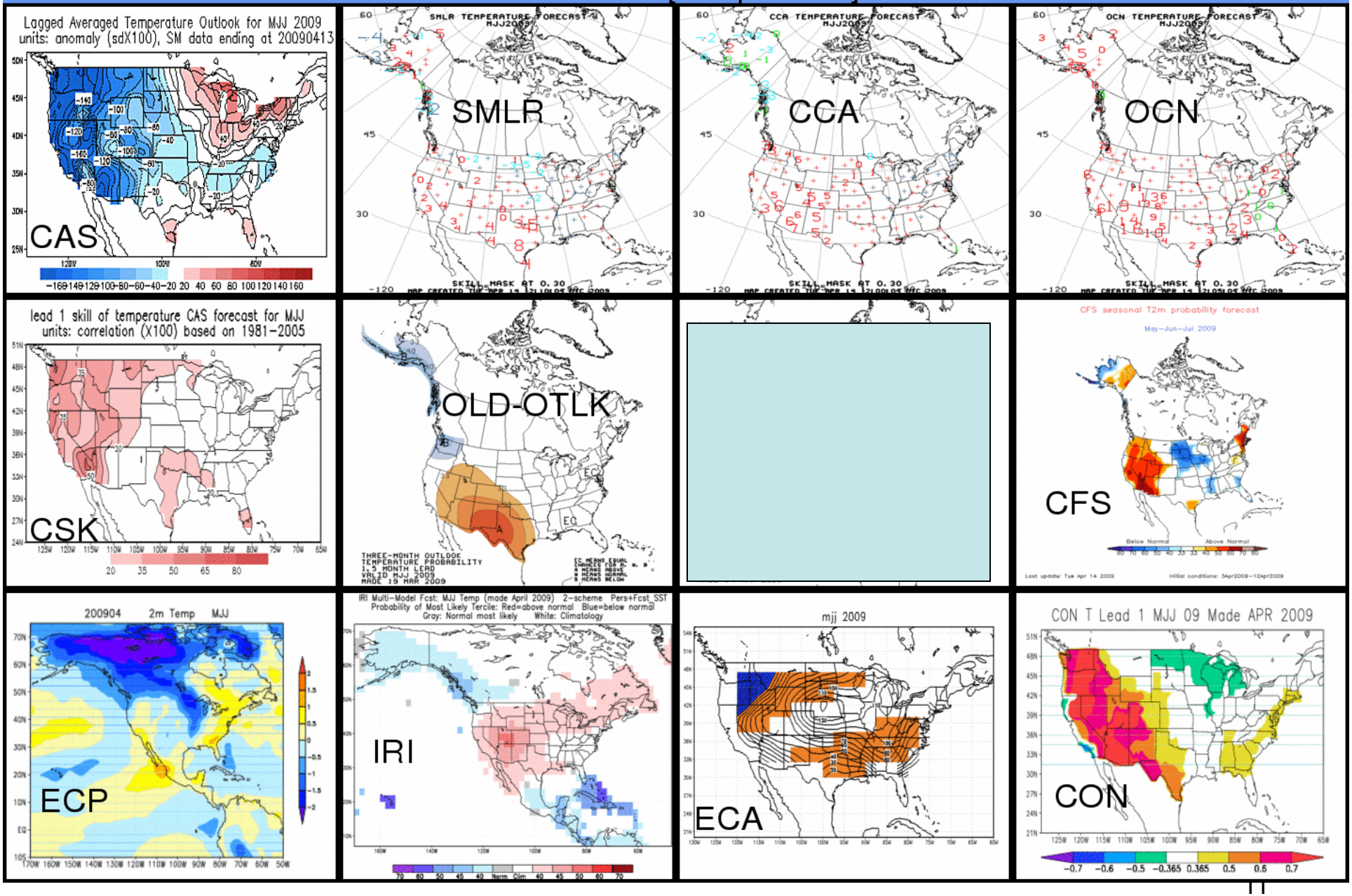
Dynamical vs Empirical Tools

Skill of tools and OFFICIAL Outlook

How easily can a new tool be included?

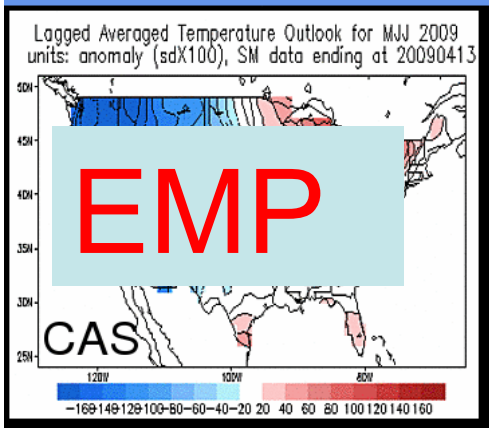
US, yes, but occasional global perspective

MJJ Season [Temperature]



From an internal CPC Briefing package

MJJ Season [Temperature]



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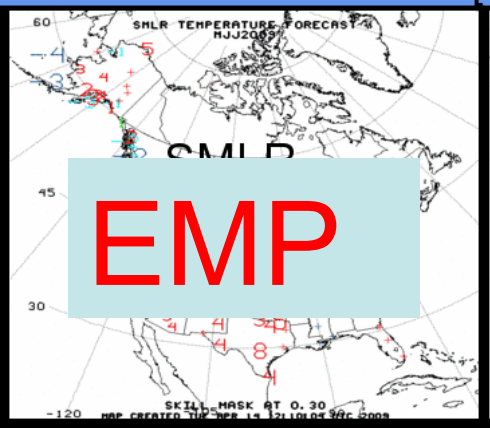

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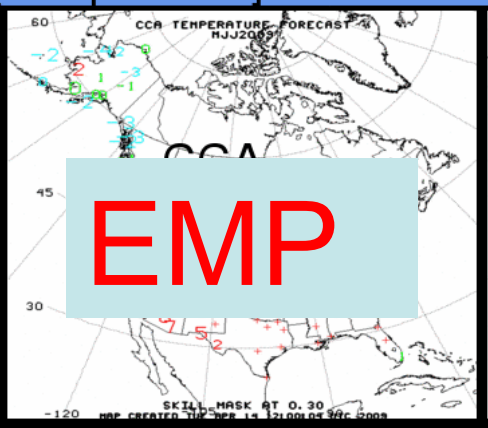

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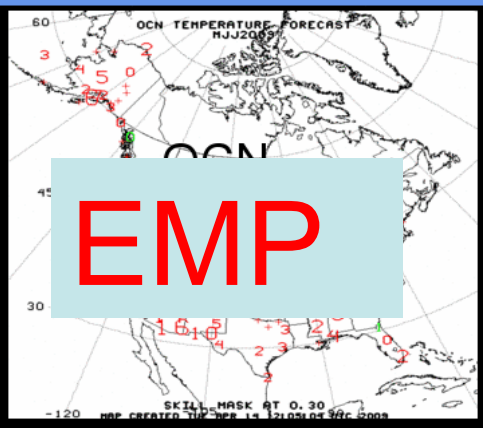

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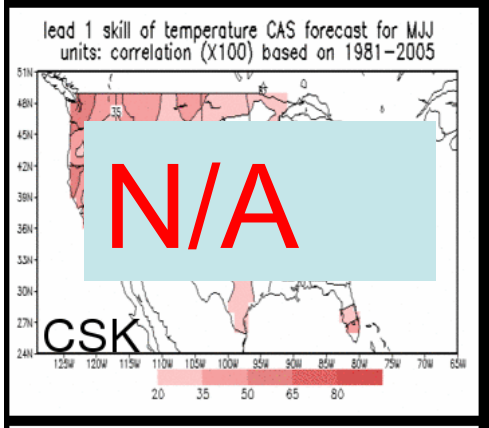
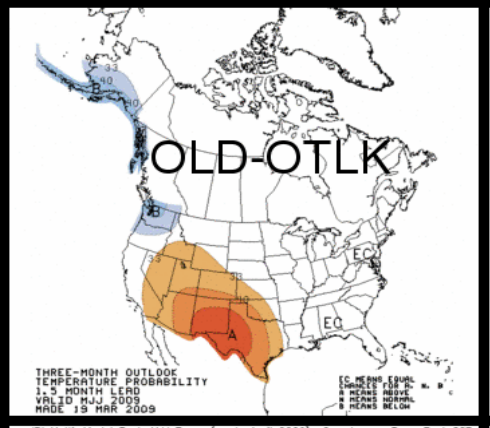
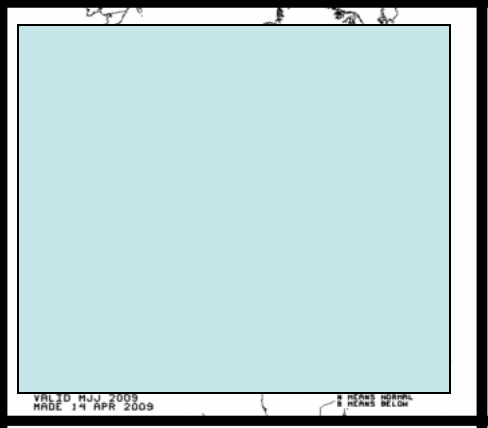
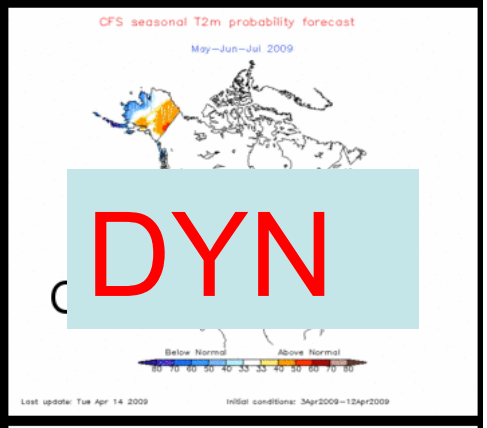


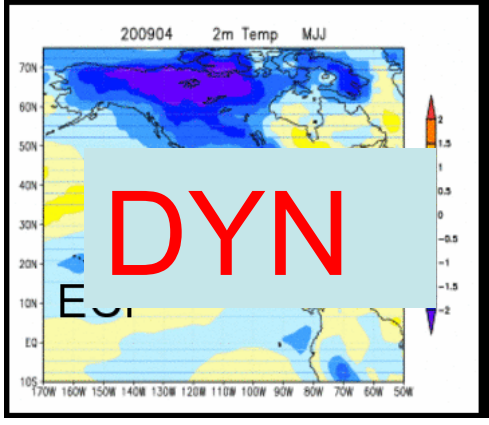
N/A







DYN



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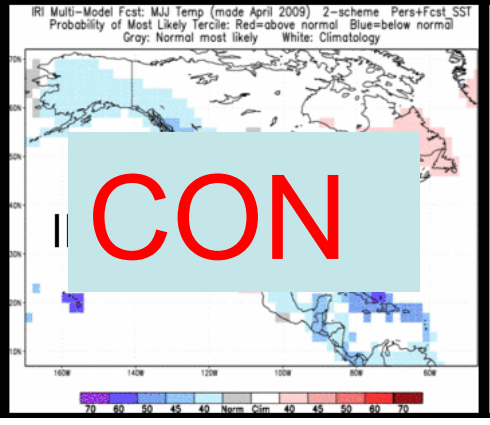
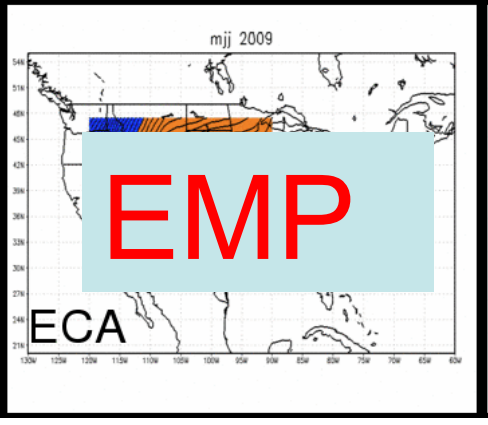


CON



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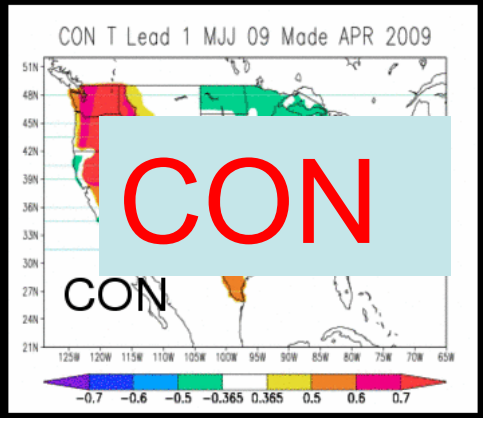


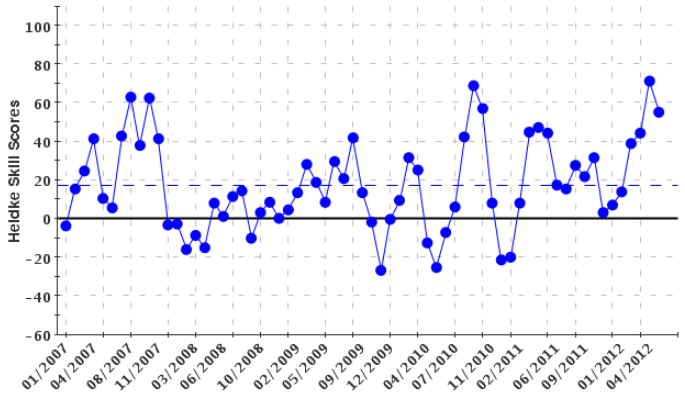
CON

Verification of Climate Outlooks

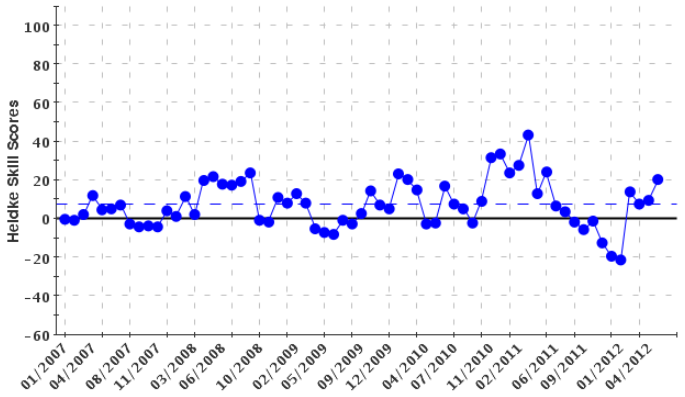
– RGB skill generally tracks the overall skill of seasonal forecasts with greater variations due to the smaller area of the region.

– On average, skill of temperature (left) and precipitation (right) forecasts for the RGB exceeds the average skill for the U.S.

Seasonal (Lead 0.5) Temperature Heidke Skill Scores for all categories from 01/2007 - 07

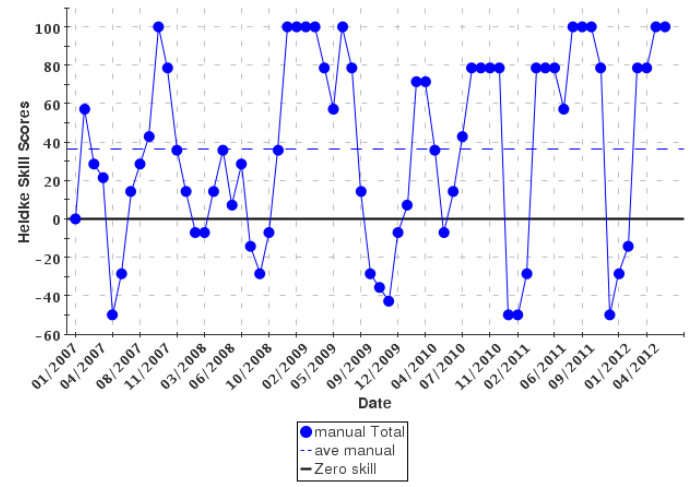


Seasonal (Lead 0.5) Precipitation Heidke Skill Scores for all categories from 01/2007 - 07

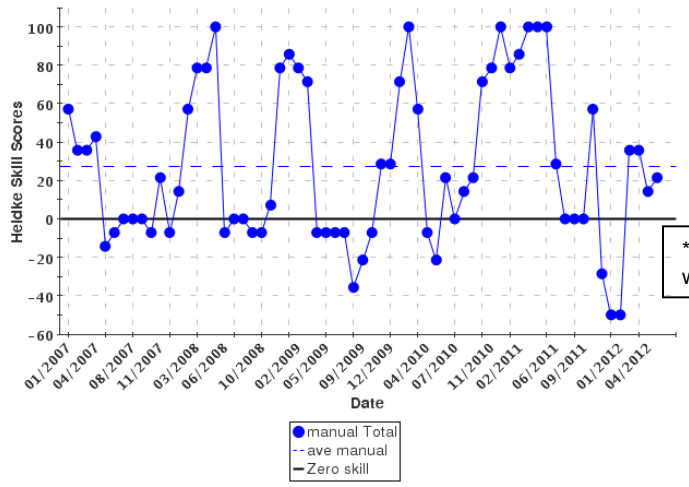


All U.S.

Seasonal (Lead 0.5) Temperature Heidke Skill Scores for all categories from 01/2007 - 07



Seasonal (Lead 0.5) Precipitation Heidke Skill Scores for all categories from 01/2007 - 07



RGB*

* US Climate Divisions within the RGB

Temperature Forecast Heidke Skill Scores :

Non-Equal Chance(non EC) forecasts: 42. 40

All forecasts: 22.84

% coverage non EC: 53.88

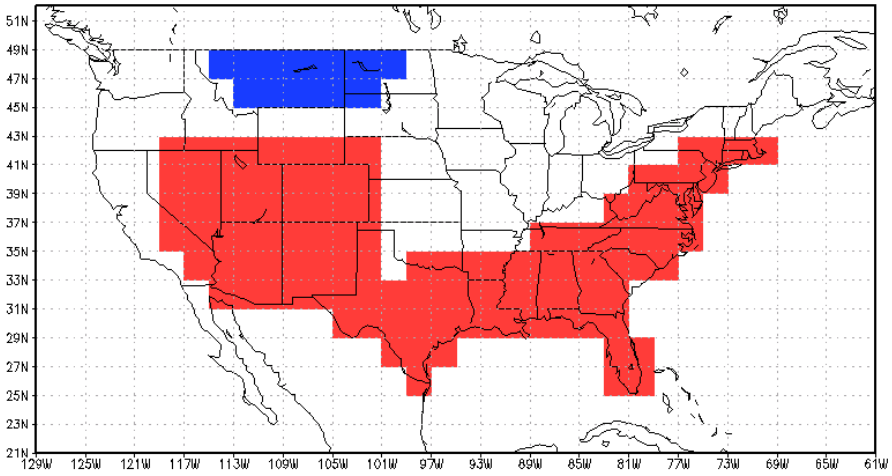
Precipitation Forecast Heidke Skill Scores :

Non-Equal Chance(non EC) forecasts: 31.25

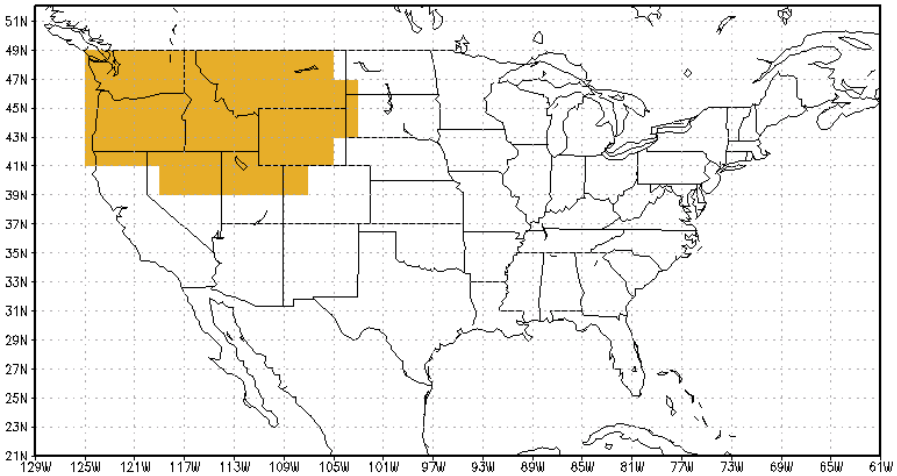
All forecasts: 6.47

% coverage non EC: 20.69

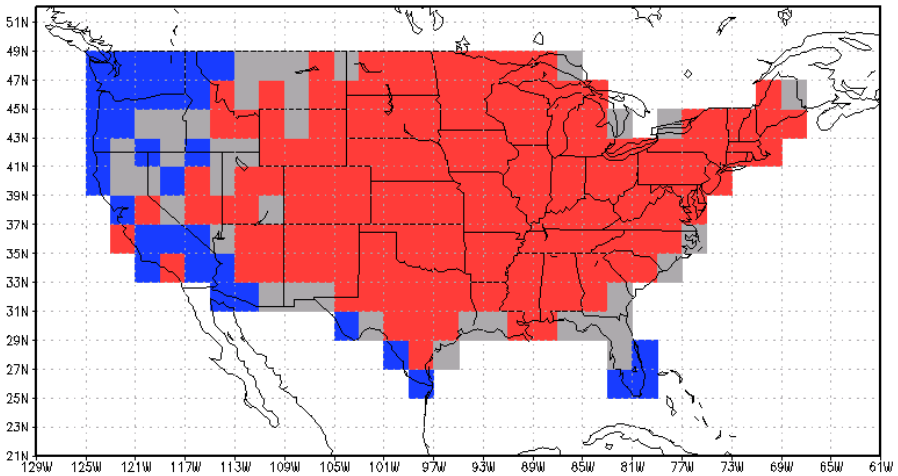
May–Jun–Jul 2012 Temp Official_Forecast



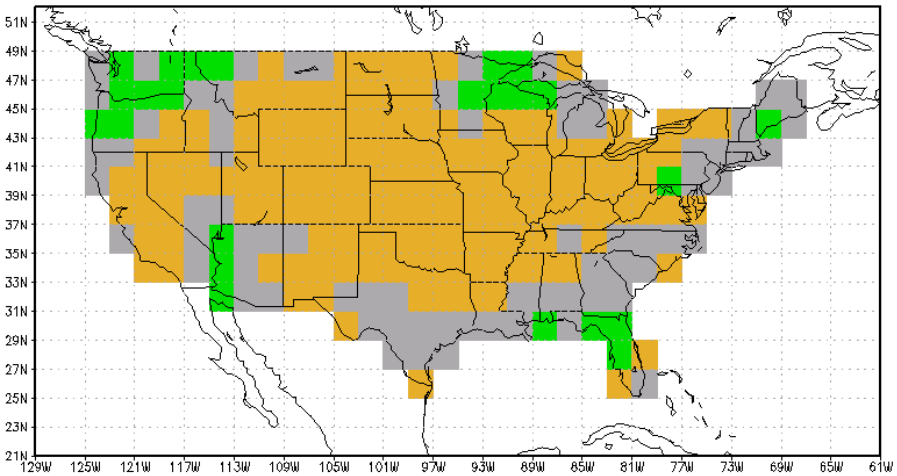
May–Jun–Jul 2012 Prec Official_Forecast



May–Jun–Jul 2012 Temp Obs_Categories



May–Jun–Jul 2012 Prec Obs_Categories



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National Weather Service

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Go

Drought Indices
- Standardized Precipitation Index (SPI)
- Palmer Drought Severity Indices (PDSI)
- Crop Moisture Indices
- Soil Moisture Percentiles (based on NLDAS)
- Standardized Runoff Index (based on NLDAS)

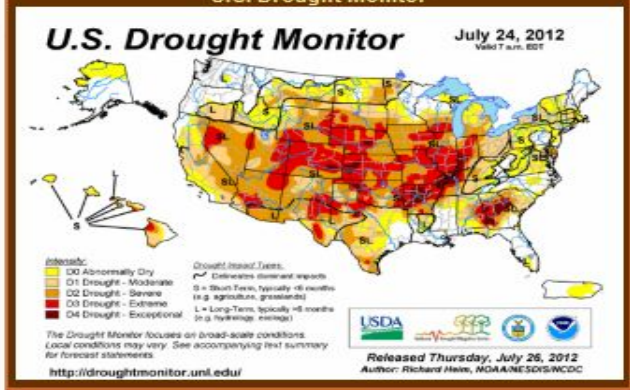
Precipitation

Surface Temperature
- Maximum/Minimum
- Mean

Surface Hydrology (based on NLDAS)
- Total Soil Moisture
- Total SM Change
- MOSAIC Soil Moisture Profile
- NOAH Soil Moisture Profile

Drought Information

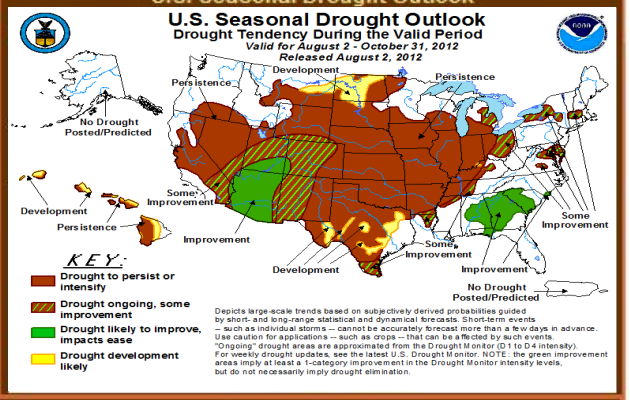
U.S. Drought Monitor



Click on the title or the graphic (above) to access the U.S. Weekly Drought Monitor

PDF Version of Graphic

U.S. Seasonal Drought Outlook



Click on the title or the graphic (above) to access the U.S. Seasonal Drought Outlook

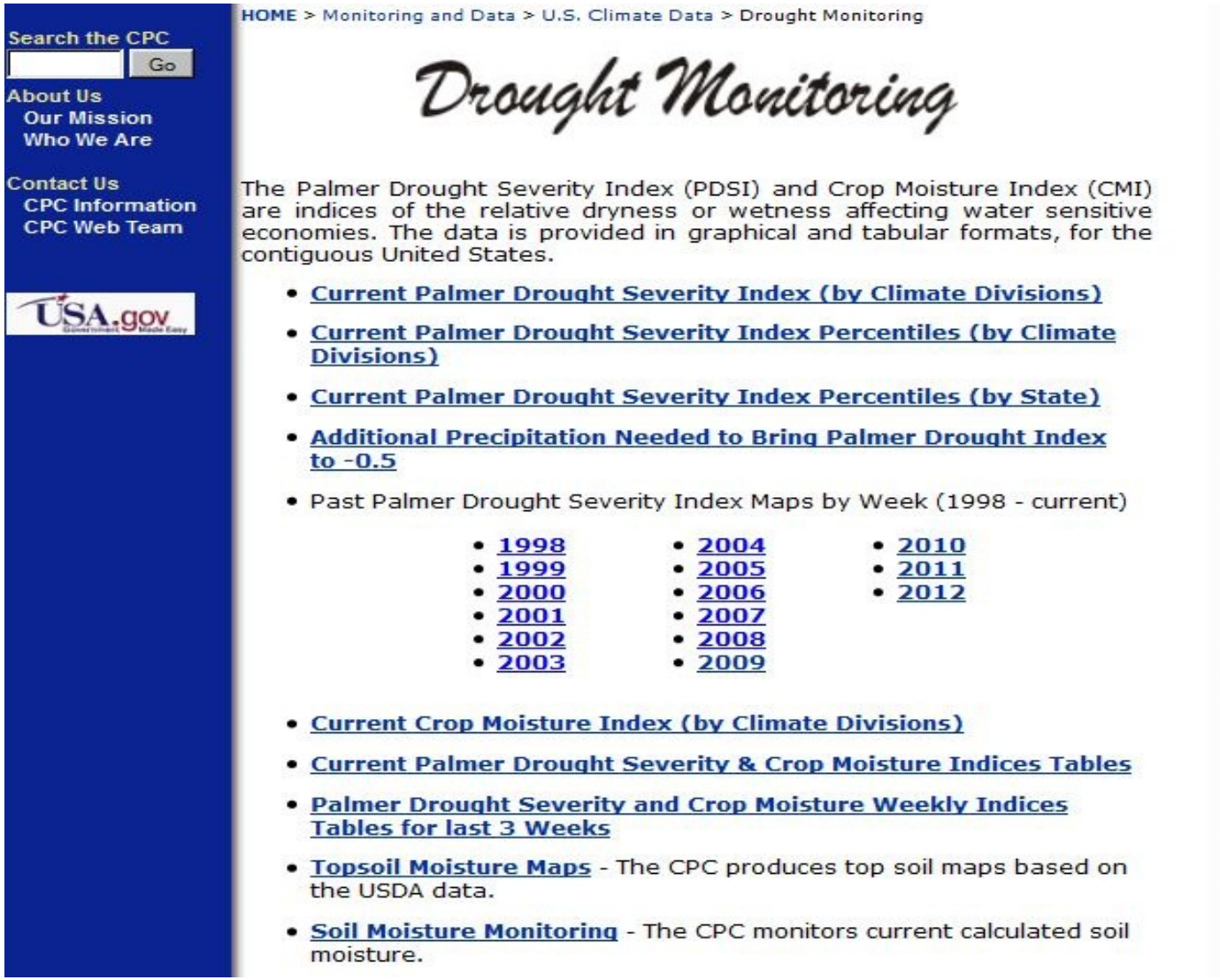
PDF Version of Graphic

Other Drought links:

- North American Drought Monitor (NADM)
- National Integrated Drought Information System (NIDIS)
- National Drought Mitigation Center (NDMC)

Drought Monitoring

Products Page



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Drought Monitoring

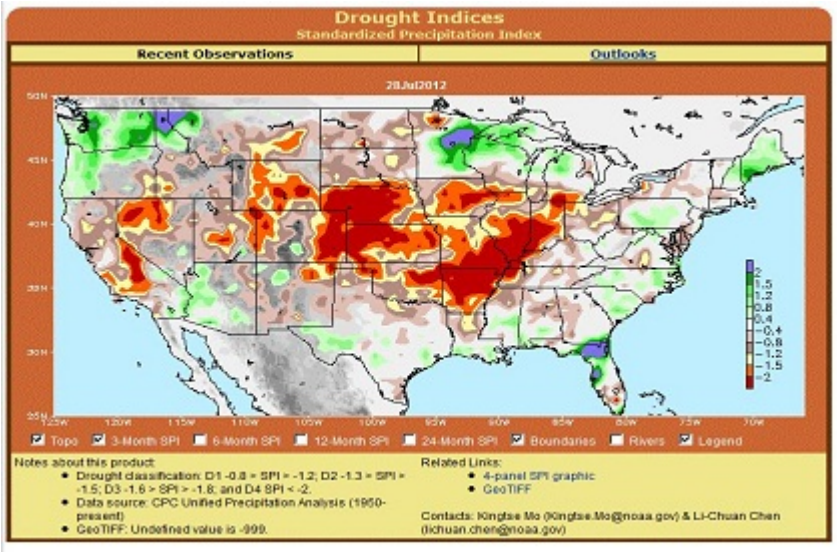
The Palmer Drought Severity Index (PDSI) and Crop Moisture Index (CMI) are indices of the relative dryness or wetness affecting water sensitive economies. The data is provided in graphical and tabular formats, for the contiguous United States.

- Current Palmer Drought Severity Index (by Climate Divisions)
- Current Palmer Drought Severity Index Percentiles (by Climate Divisions)
- Current Palmer Drought Severity Index Percentiles (by State)
- Additional Precipitation Needed to Bring Palmer Drought Index to -0.5
- Past Palmer Drought Severity Index Maps by Week (1998 - current)
  - 1998
  - 1999
  - 2000
  - 2001
  - 2002
  - 2003
  - 2004
  - 2005
  - 2006
  - 2007
  - 2008
  - 2009
  - 2010
  - 2011
  - 2012
- Current Crop Moisture Index (by Climate Divisions)
- Current Palmer Drought Severity & Crop Moisture Indices Tables
- Palmer Drought Severity and Crop Moisture Weekly Indices Tables for last 3 Weeks
- Topsoil Moisture Maps - The CPC produces top soil maps based on the USDA data.
- Soil Moisture Monitoring - The CPC monitors current calculated soil moisture.

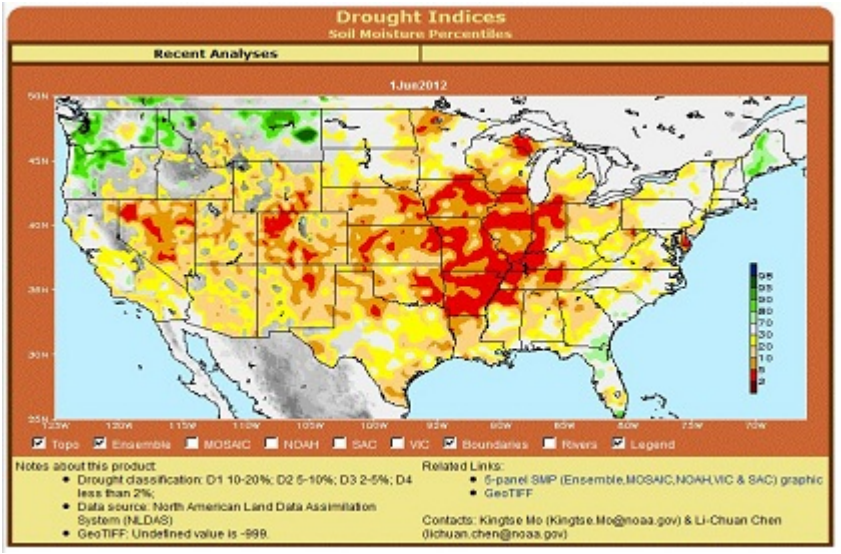
http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

Drought Monitoring

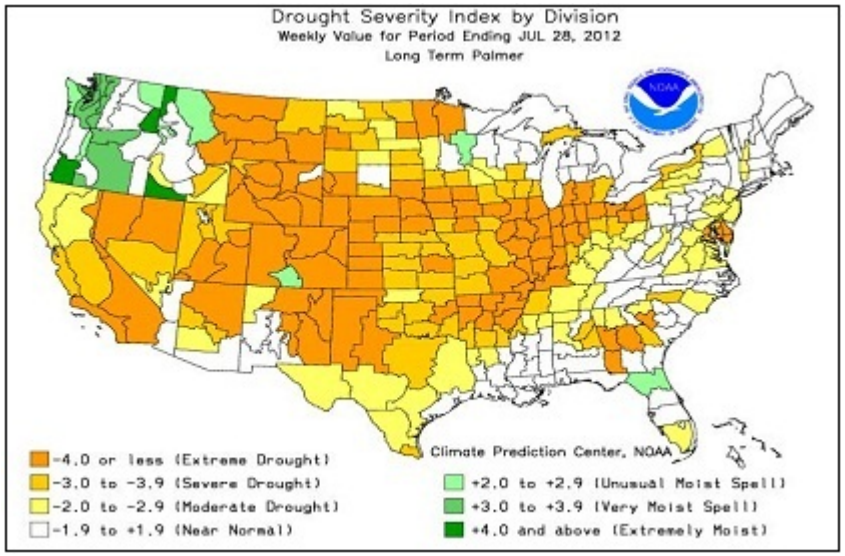
Drought Indices



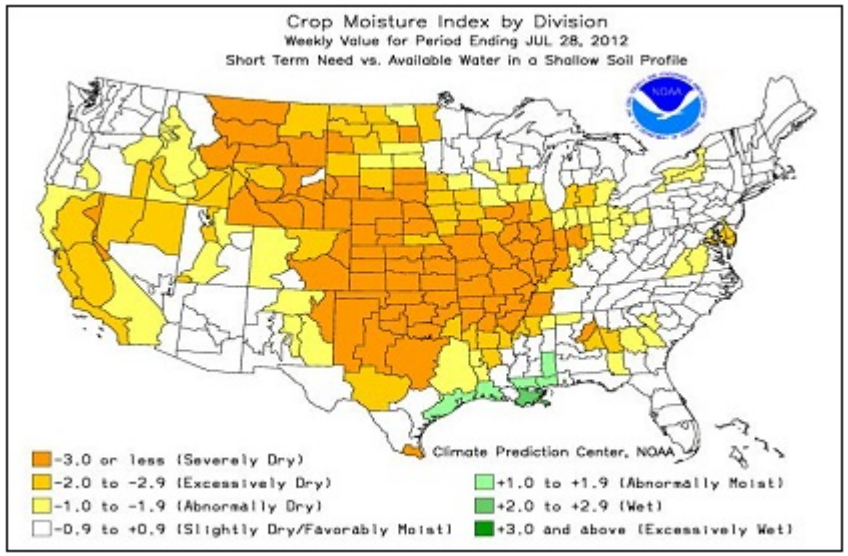
Standardized Precipitation Index



Soil Moisture Percentiles

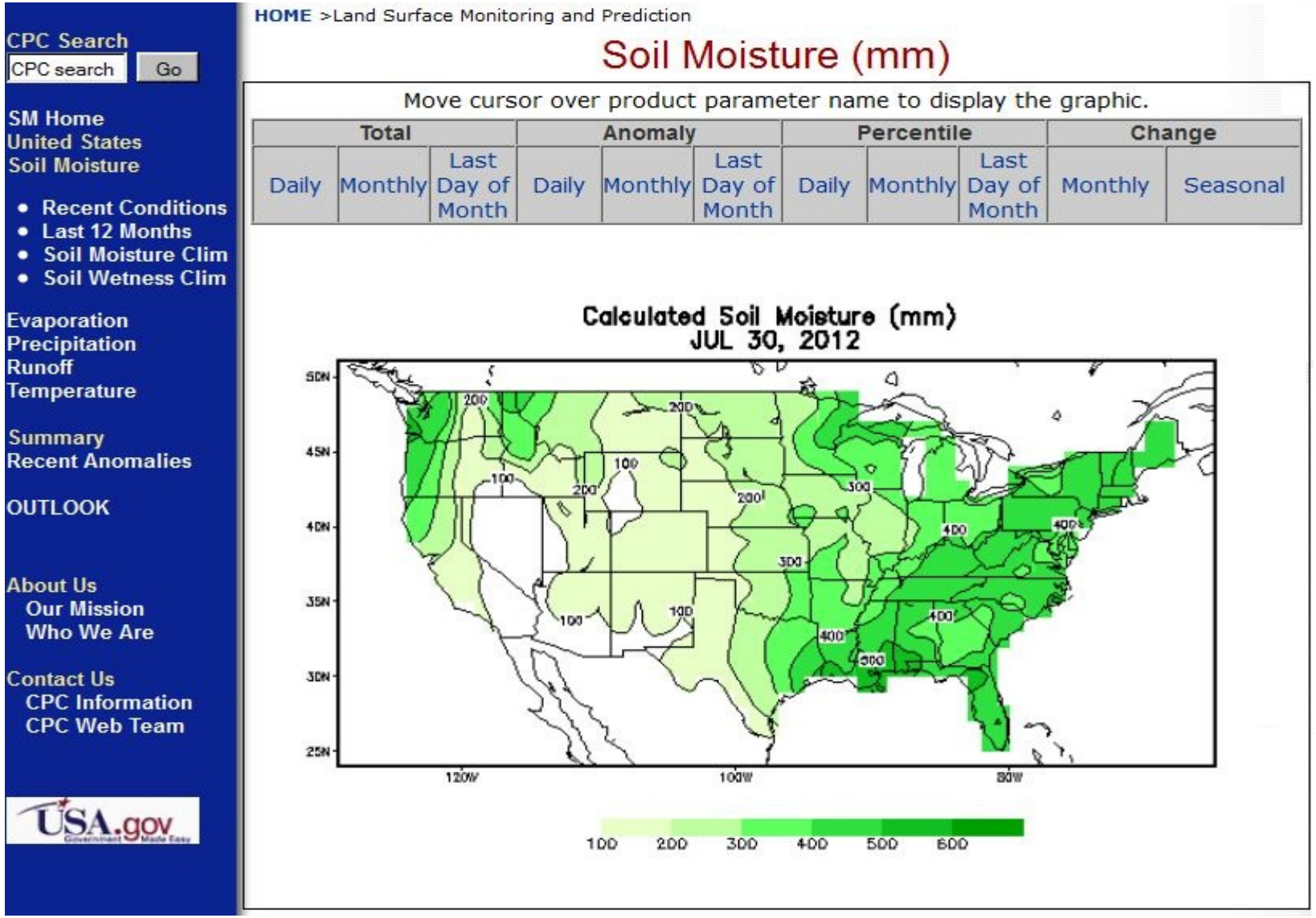


Drought severity Index (Long-Term Palmer)



Crop Moisture Index

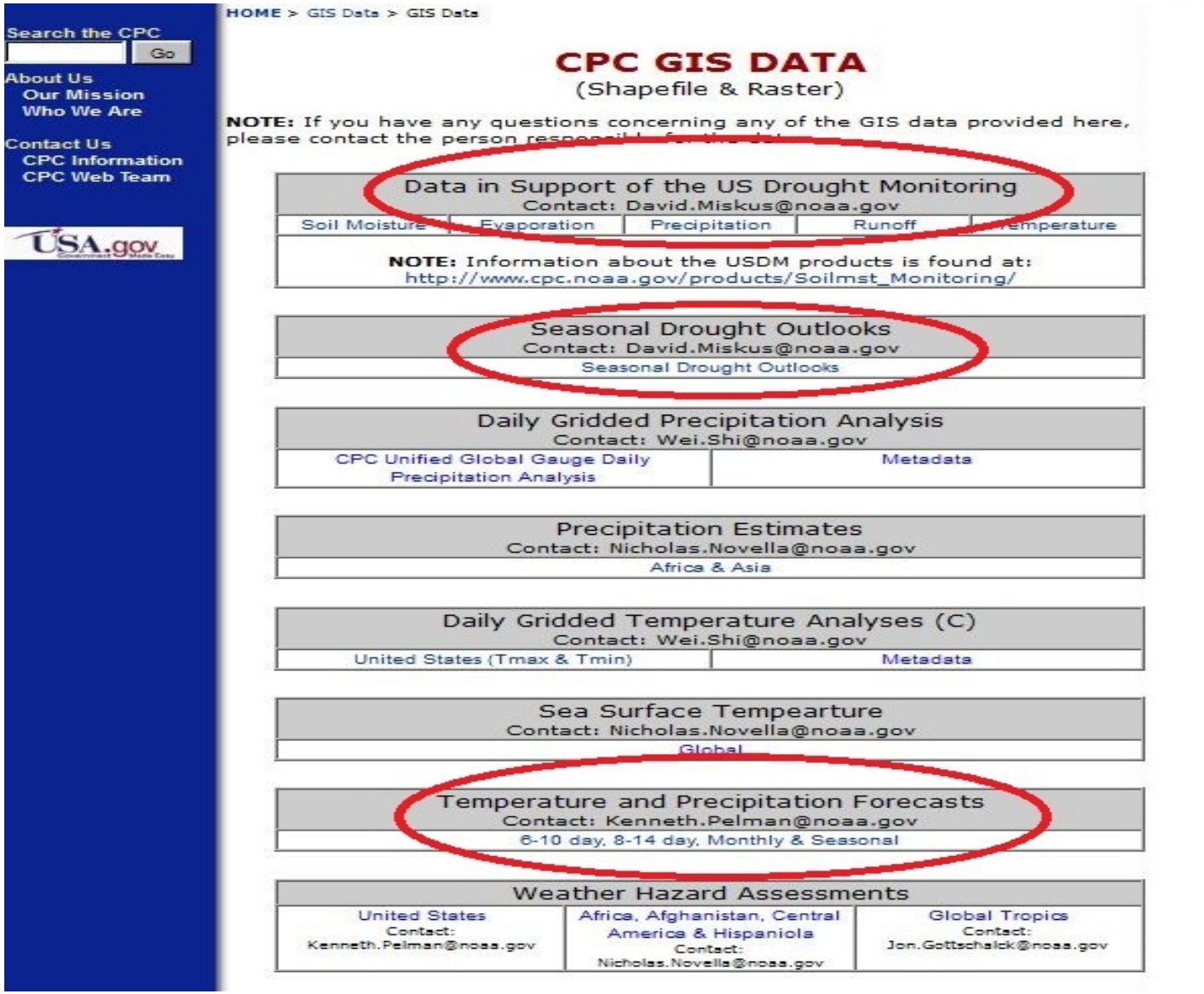
Soil Moisture Monitoring



(http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml)

GIS Data

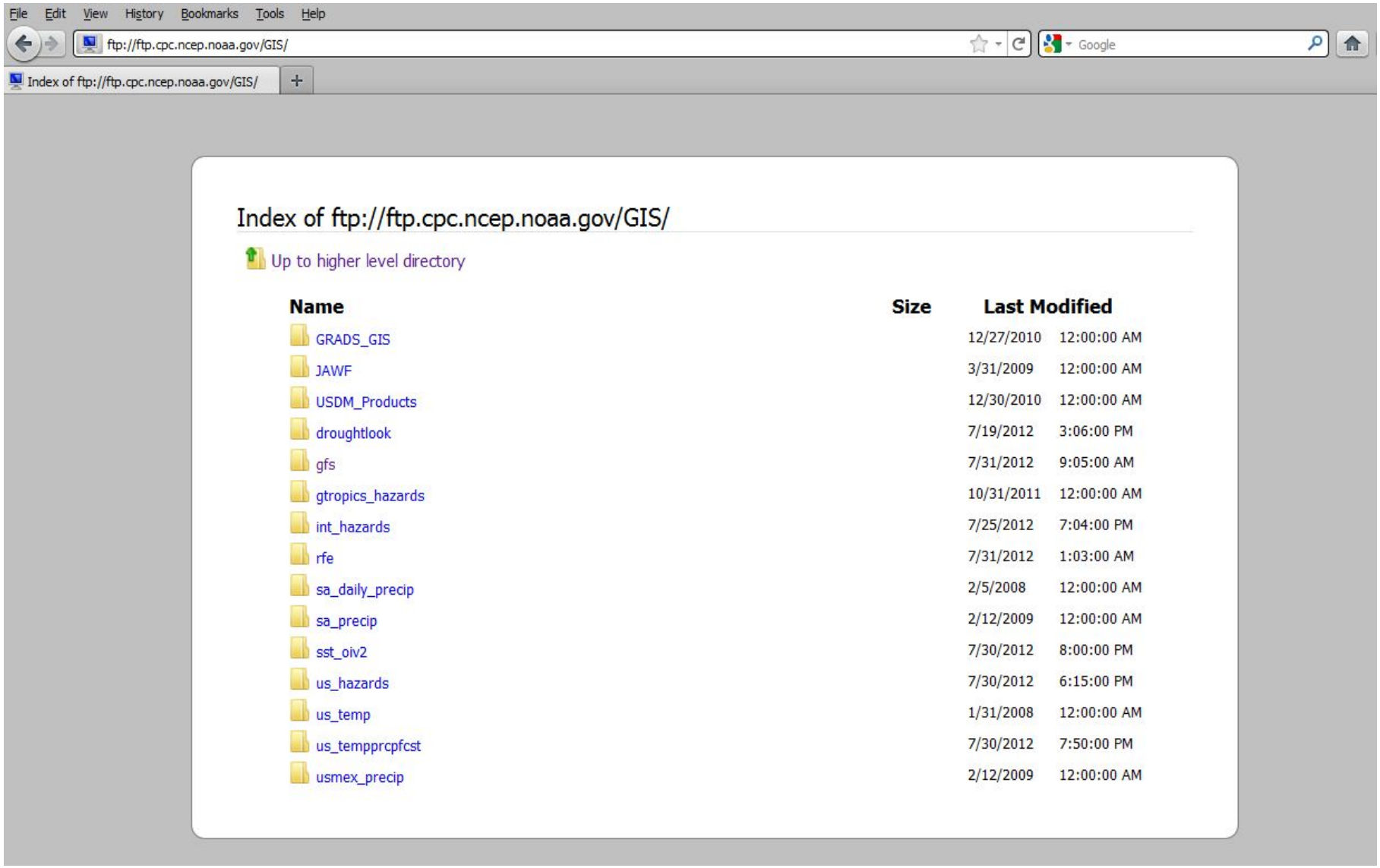
Web Access



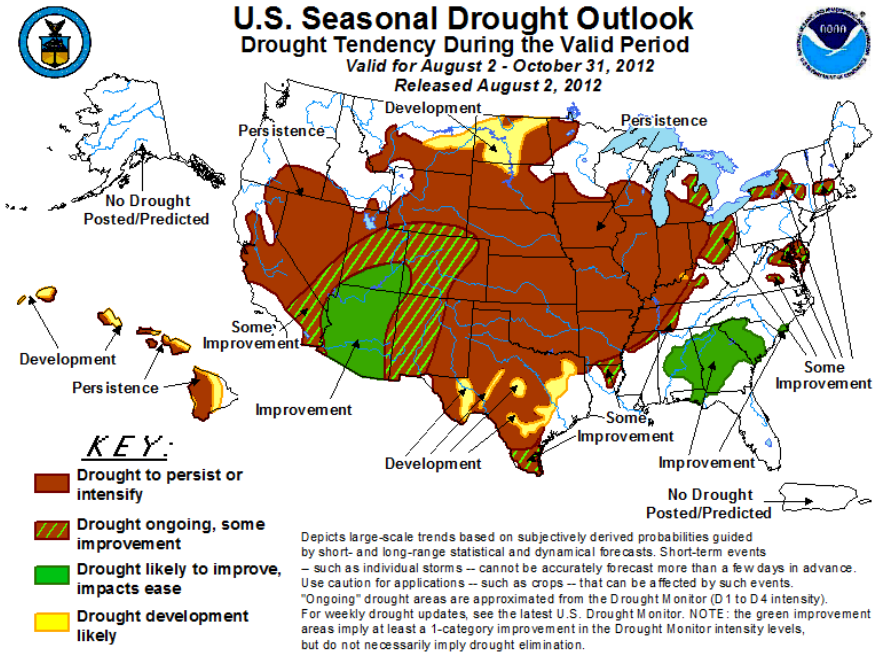
http://www.cpc.ncep.noaa.gov/products/GIS/GIS_DATA/

GIS Data (cont.)

FTP Server Access



CPC Seasonal Drought Outlook

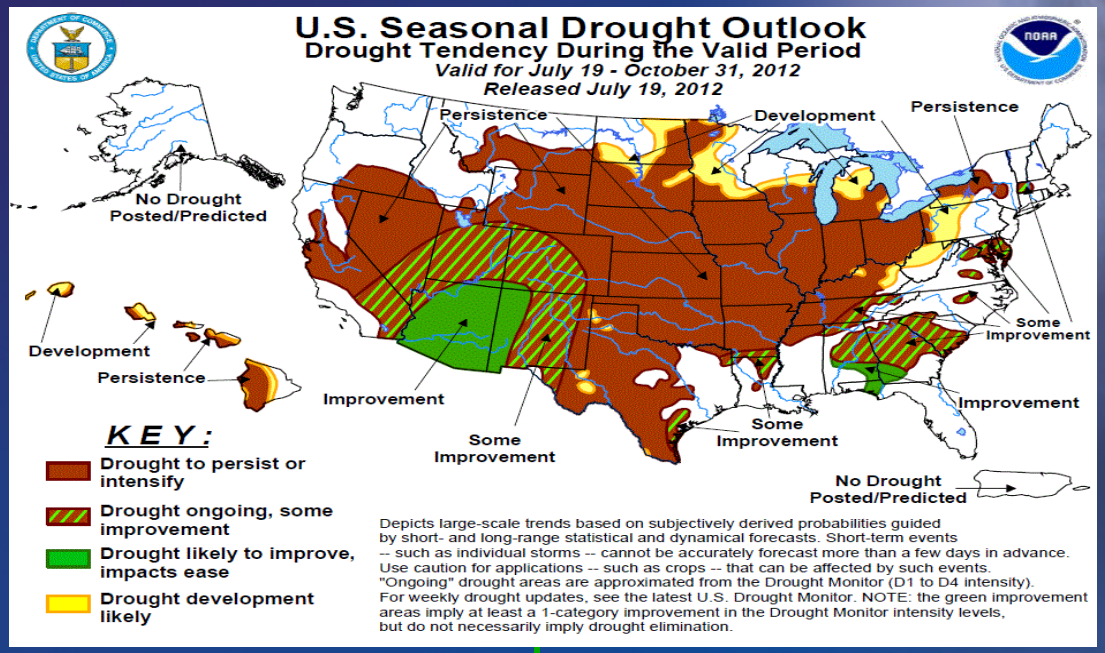


- Originated in August 1999—public in March 2000
- Issued twice a month
- Intent is to present a simple national picture of where droughts will improve, persist, or develop
- Provide useful information to agriculture and hydrology communities

How Does CPC Make Operational Seasonal Drought Outlooks?

- Seasonal drought outlooks are based upon current drought conditions (at least moderate drought - D1 from the most recent USDM)
  - Ensure consistency with 1- and 3-month CPC climate outlooks, especially precipitation
- Forecasters adjust the outlook (especially where CPC climate outlooks are EC) based on:
  - Recent Trends in USDM
  - Agricultural & hydrologic indicators (e.g. streamflow, soil moisture, cumulative precipitation)
  - Extended-range forecasts
  - Monthly & Seasonal Forecasts and Ensembles (e.g. CFSv2 SPI & soil moisture, NLDAS soil moisture, Ensemble Streamflow Prediction)
  - Monthly / seasonal climatology
- Outlook is released to a USDO email exploder for repeated review and suggestions from participants during its production (Mon-Wed)
- Release dates: 1) Initial USDO: every third Thursday of the month (w/1- & 3-month CPC Outlooks)
  2) Updated USDO: every first Thursday of the month (w/1-month updated CPC Outlooks)

Drought Forecasting: Short and Long-Term Forecast Contributions



Start with latest U.S. Drought Monitor D1 areas

Short to Extended Range (HPC 1-5 Day Precip, CPC 6-10/8-14 Forecasts, Soil Moisture Forecasts)

3-month Precipitation and Temperature Outlooks (ENSO Composites)

Verification of Drought Outlook

- Initial drought conditions (at least D1) & verifications for the US Seasonal Drought Outlook are taken from the weekly U.S. Drought Monitor approximately 3 months apart.

- Verification Categories:
  - Persistence = USDM level stayed the same or deteriorated
  - Development = USDM level now at D1 or worse, was D0 or no drought previously
  - Improvement = USDM category improved 1 or more categories
  - Some Improvement = no score (an issue)

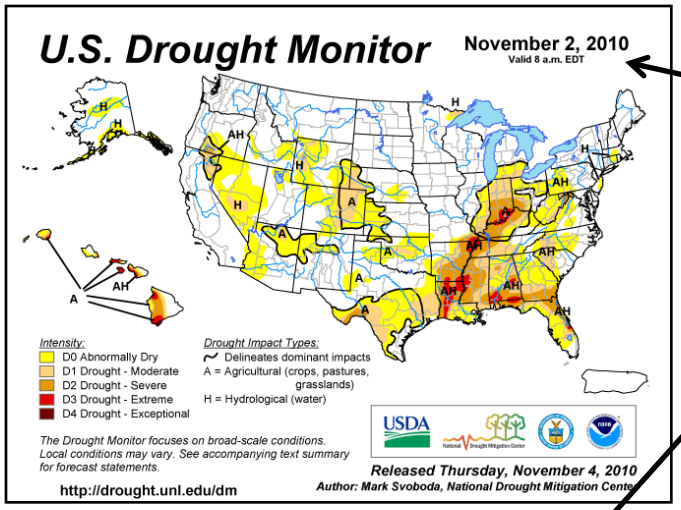
- Scoring: Based upon 4-km grid
  - Number of grid points correctly forecast vs number incorrectly forecast using above criteria
  - Not scored: "Some Improvement" areas & where drought didn't exist and did not develop

- Skill: Refers to difference between the USDO score vs the score of a baseline persistence forecast

- Underlying Issues:
  - Significant skill in forecasting vector of existing drought [i.e. persist/worsen or improve]
  - Little skill in forecasting drought development
  - Scores are better in the RGB (and elsewhere) during La Nina & El Nino winters

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

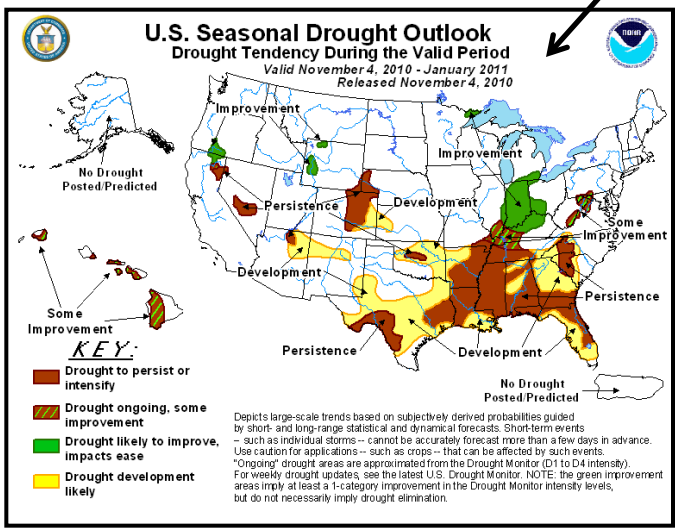
Verification of Drought Outlook

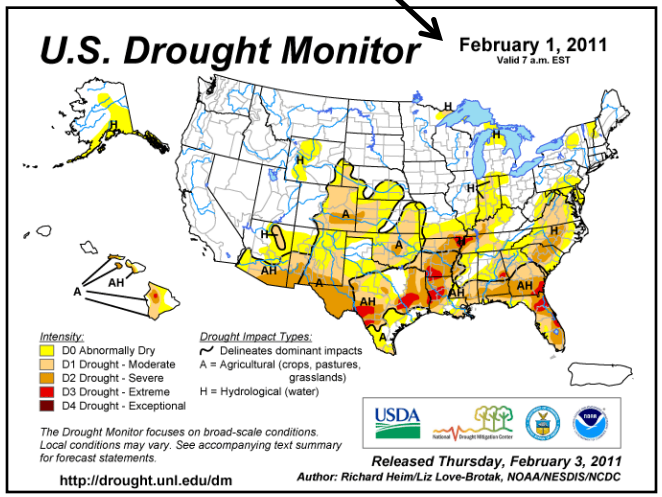


1. Start with Initial USDM; used 11/2/10 (≥ D1) for ND'10J'11 USDO

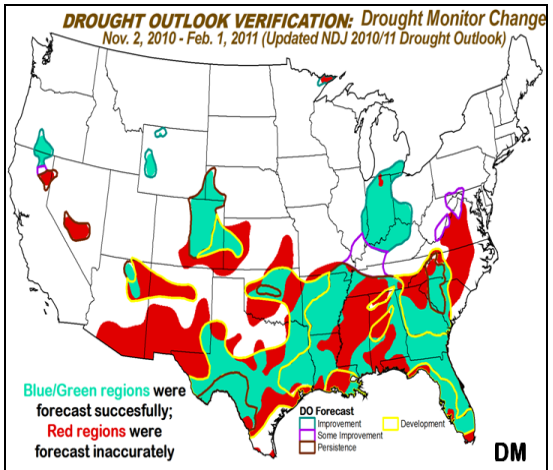
2. Forecast drought (≥D1) at end of Jan 2011 (La Nina was ongoing)

3. Three-months later, verify drought at end of Jan 2011 (used 2/1/11 USDM)

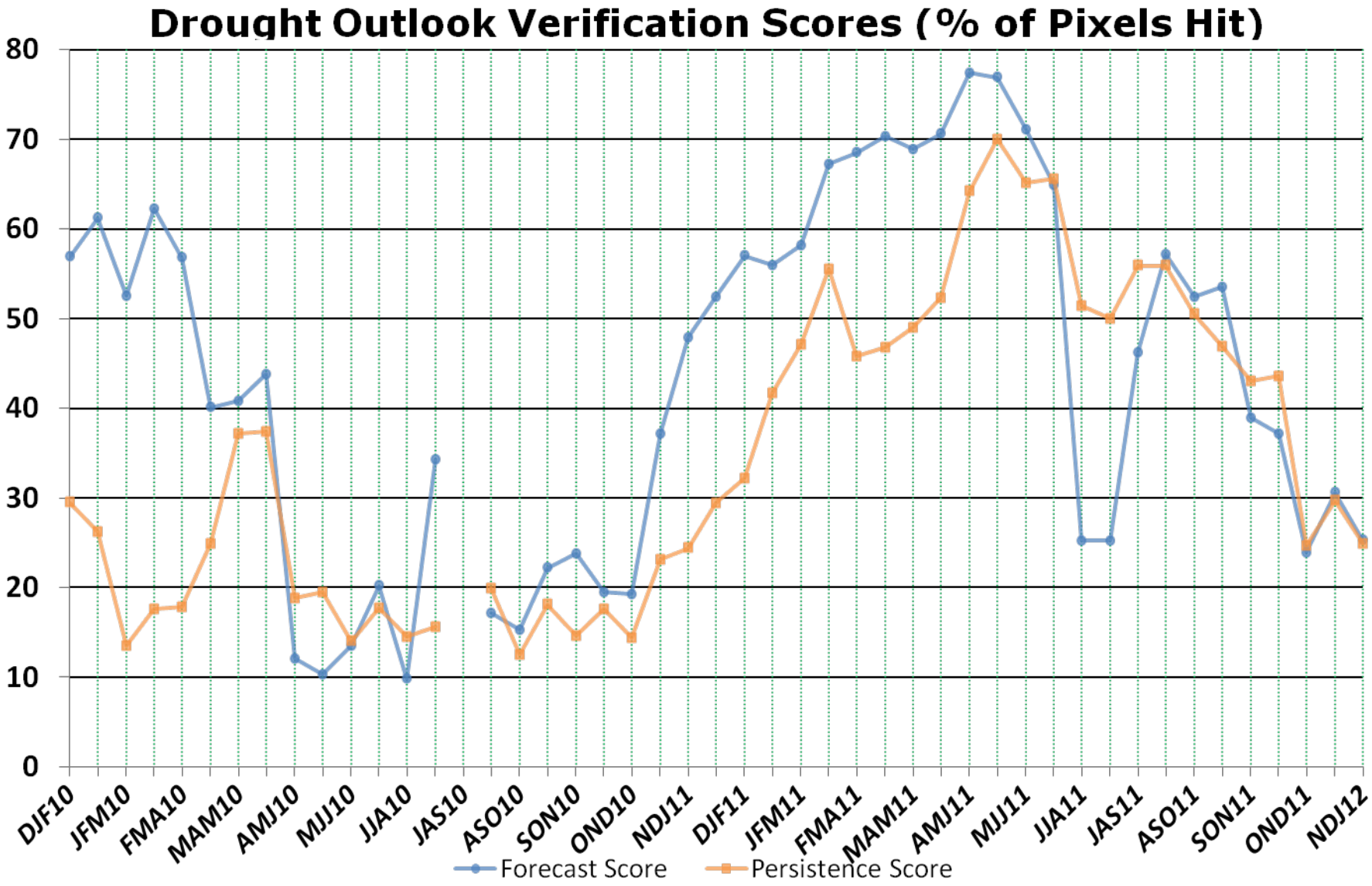




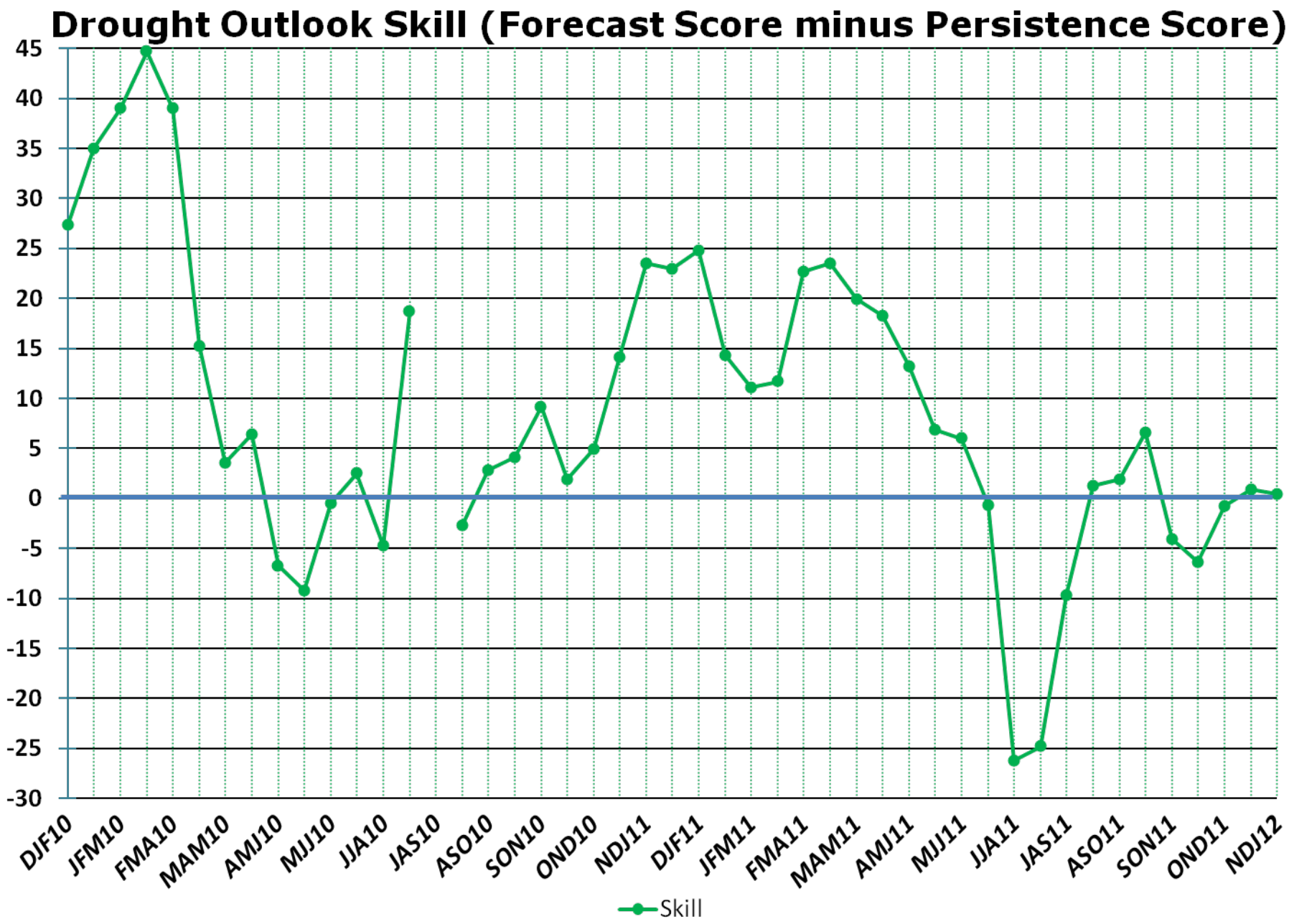
4. Compare USDO categories and make verifications (*Some Improvement* not scored)

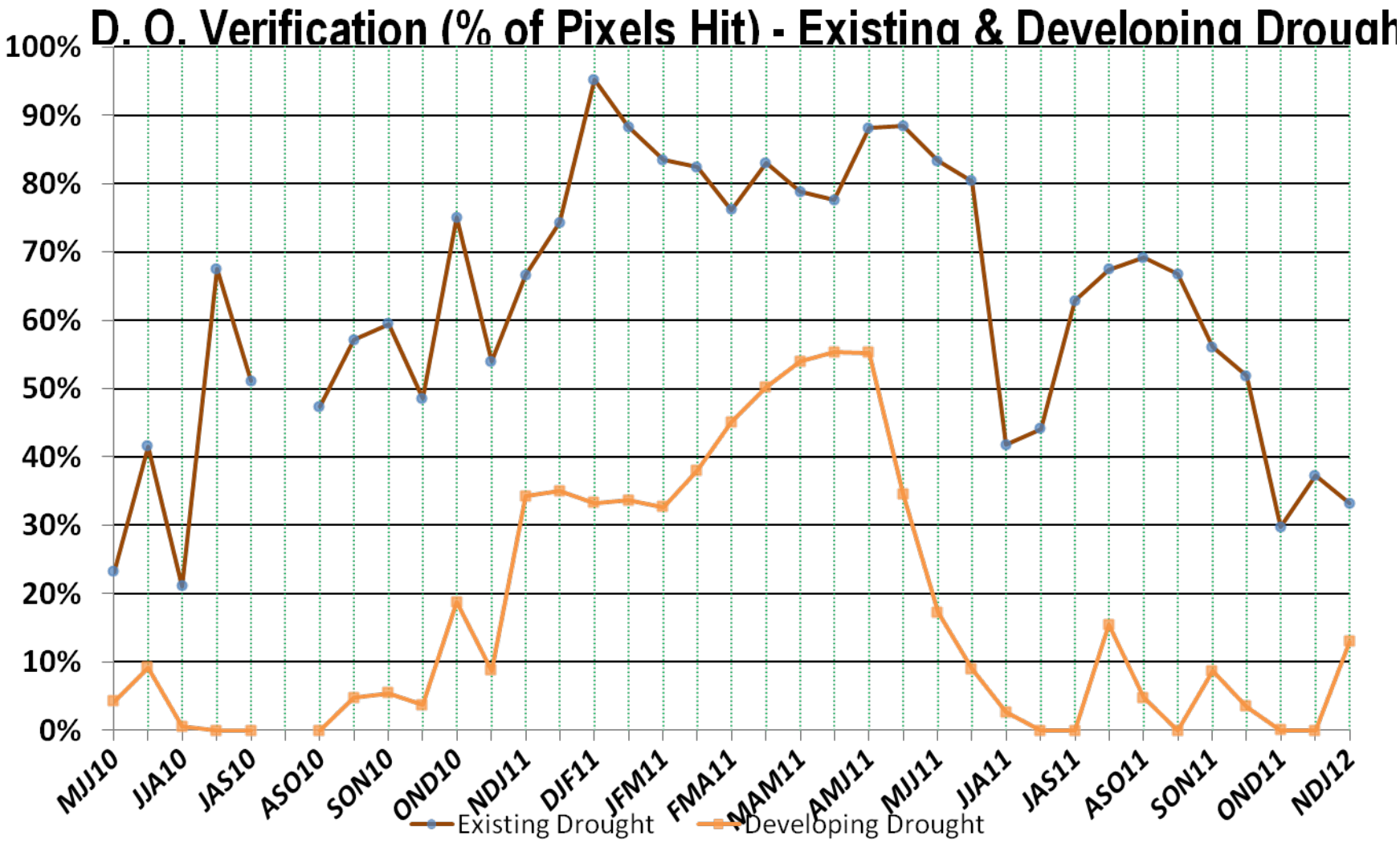


FORECAST	HIT	MISS
Improvement	11,511	454
Persistence	39,438	17,223
Development	30,377	56,249
TOTAL	81,326	73,926
SCORE	***52.4%***	
PERSISTENCE FORECAST BASELINE	41,625	99,940
PERSISTENCE FORECAST SCORE	***29.4%***	
"SKILL"	*(forecast score) minus (persistence score)*	***+23.0***



Forecasts generally beat persistence; hit a rough patch late last year; better forecasts issued in winter and last winter enhanced further because of La Nina signal; not enough history to break down seasonal averages


Drought Outlook Skill (Forecast Score minus Persistence Score)
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
DJF10
JFM10
FMA10
MAM10
AMJ10
MJJ10
JJA10
JAS10
ASO10
SON10
OND10
NDJ11
DJF11
JFM11
FMA11
MAM11
AMJ11
MJJ11
JJA11
JAS11
ASO11
SON11
OND11
NDJ12
Skill



CPC does much better forecasting existing drought vector than where it will develop; but decent development scores (and more aggressive forecasts) during the La Nina winter.

How is CPC Incorporating Users of Climate Outlooks?

- **Seasonal Climate (P&T) Outlooks**
  - Conference calls
    - ✓ Review the current climate state and previous forecasts (Friday before release)
    - ✓ Review the forecaster's preliminary maps (Tuesday before release)
    - ✓ Mexico has been participating in these
- **Seasonal Drought Outlooks**
  - DM / DO exploder lists
  - **Monthly Drought briefing**
- **More Generally**
  - Coordination with NWS Climate Services Division, Regions and Field
  - NACSP
  - NIDIS
  - ……

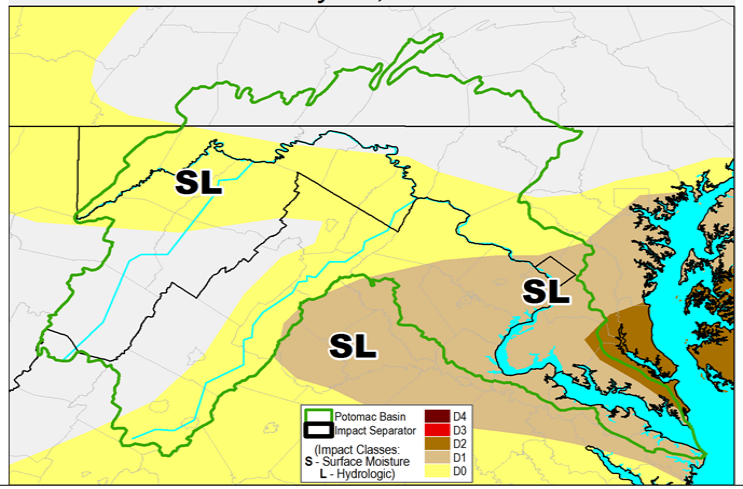
What are Some Opportunities for Enhanced Collaboration Within the Region?

- Current National Outlooks
  - Verification of current outlooks in the RGB may be a useful starting point to identify future opportunities for new or enhanced regional-scale outlook information in the RGB.
- Future Regional Outlooks
  - Explore ways to make NWS/CPC national outlooks more useful for RGB constituents (e.g. downscaling)
  - Establish regional partnerships (e.g. Potomac Basin Drought Monitor partners CPC & Regional Council of Governments)
  - Enhance Quarterly Climate Impacts and Outlooks Documents
  - Ensure consistency between national outlooks and regional products and services in the NIDIS Pilot regions
  - Provide objective drought forecasts to RCC's / regional centers and get their feedback
  - Enhance RCSD, CSPM and international participation in CPC monthly drought briefings

Regional Outlooks

Potomac Basin Drought Monitor

July 31, 2012



Selected Basin-Average Indices on July 29, 2012

	Raw Value	Anomaly	Percentile
Palmer Drought	-1.28	-1.54	30.0 [D0]
Palmer Hydrologic	-1.59	-2.03	27.5 [D0]
Palmer Z	-0.33	-0.50	46.2 [--]
CPC Soil Moisture	n/a	n/a	46.0 [--]
1-Month Precipitation	4.57"	+0.63"	68.5 [--]
3-Month Precipitation	12.48"	+0.45"	61.3 [--]
6-Month Precipitation	18.82"	-2.69"	30.4 [--]
12-Month Precipitation	45.03"	+3.26"	75.3 [--]
24-Month Precipitation	86.84"	+3.26"	73.8 [--]

Basin Coverage: 39.2% Not Dry 38.7% D0 21.2% D1 0.9% D2 *Basin Average*: D"-0.16"

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

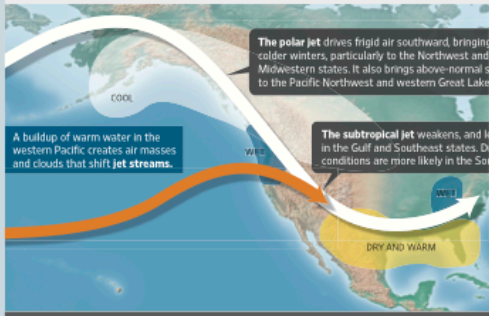
Regional Outlooks

Snow, Rain, Heat and Gloom of Night

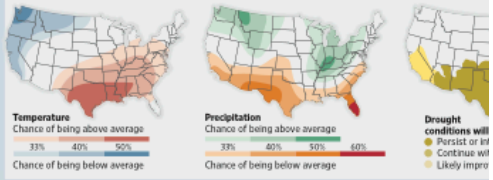
This year's La Niña weather pattern is expected to be a weak one, peaking in the winter months. Bu exacerbate conditions in vulnerable areas devastated by the floods, tornadoes, wildfires and droug Last year broke the record for the number of climate-related disasters that caused billion-dollar da U.S., according to the National Oceanic and Atmospheric Administration.

—Elaine He, Joe Barrett

How does it affect the U.S.?



Forecasts for the first three months of the year



What will it mean for 2012?

Government and businesses are watching for disruptive—or beneficent—weather. Some preparations

Retail/Energy

- Increased energy consumption from cold Northeastern winter in mid- to late January, once warm pattern in region subsides.
- Relatively short, intense winter expected for the upper Great Lakes region and Northeast spurs retail sales in spring and early summer.
- Less cocoon-like behavior in Pacific Northwest boosts commerce in spring and summer if precipitation is lower than last year.
- Lake Tahoe ski season off to dry start, but good season for winter sports still possible if warm weather goes coastal, keeping rain away from mountains.

Agriculture

- Cattle ranchers in New Mexico cautiously optimistic for spring; wetter-than-predicted December good for thirsty beasts. In Texas, possible extension of drought may further squeeze hay and feed resources.
- Spring breaks early in South, permitting longer planting season for cotton, wheat, corn and soy.
- Florida citrus growers concerned about a recent dry stretch extending and threatening size of orange crop.
- Grim news for oyster growers on Atlantic and Gulf coasts if winter is warm and dry—better conditions for a parasite that can kill oysters.

Government

- Spring drought co and Southeast bett But in worst-case s spring and summe and trigger tighter restrictions.
- Drought distresse reducing shrimp, cr for fishing industry 2007 drought and 2010 Gulf oil spill.
- After last year's record floods, Army Corps of Engineers is racing to make repairs to levees near confluence of Ohio and Mississippi rivers. Corps is spending some $50 million to repair about 70 miles of critical levees along Missouri River. Expects to have 3% more space for floodwaters in reservoirs in Montana and Dakotas.

Maps by Renée Rigdon/The Wall Street Journal

Sources: National Oceanic and Atmospheric Administration; Planalytics; Army Corps of Engineers; Don Toussaint, Apalachicola River Keeper; Keith T. Ingram, Southeast Climate Consortium; Bob Rose, Lower Colorado River Authority; Willard Ferguson, Habersham County, Georgia; Susan E. Ford, Haskin Shellfish Research Laboratory; SnowSports Industries America; New Mexico Cattle Growers' Association; Texas and Southwestern Cattle Raisers Association; Highlands County Citrus Growers Association

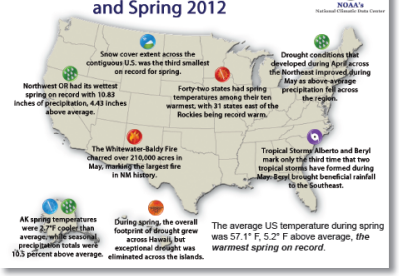
2 Jan 2012 Wall Street Journal

Quarterly Climate Impacts and Outlook — Western Region

Spring 2012

National - *Significant Events for March - May 2012*

Significant Events for May and Spring 2012



The average US temperature during spring was 57.1° F, 5.2° F above average, *the warmest spring on record.*

Highlights for the West

Mountain snowpack in the Northwest continued to increase due to below-average temperatures and above-average precipitation.

Sub-par mountain snowpack in the Southwest rapidly disappeared in response to exceptional warmth and lack of moisture.

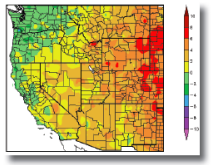
Critical fire conditions (low relative humidity, high wind, drought conditions) persisted across much of the Southwest, allowing wildfires to develop and spread rapidly.

Southwest winds in excess of 50 mph drove a dust storm into the Four Corners region which combined with wildfire smoke to reduce regional visibility and air quality.

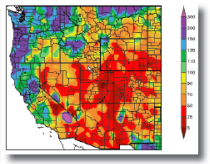
Equatorial Pacific sea surface conditions have transitioned from La Niña to ENSO-neutral conditions. These conditions are expected to continue through the summer.

Regional - *Climate Overview for March - May 2012*

Temperature and Precipitation Anomalies

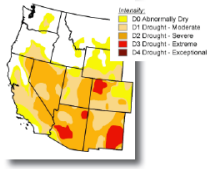


Departure from Normal Temperature (F) 3/1/2012 - 5/31/2012



Percent of Normal Precipitation (%) 3/1/2012 - 5/31/2012

Drought in the West



US Drought Monitor 6/5/2012

The temperature anomalies shown in the left panel indicate that most of the interior West had above-normal temperatures (warm colors), with slightly cooler-than-normal temperatures in the Northwest and the northern and central California coastal region.

The Pacific Northwest and much of California had well above-normal precipitation, while most of the interior West received much less precipitation than normal. Oregon had the wettest spring in the last 118 years and Washington had the third wettest. (Provisional temperature and precipitation data courtesy of the High Plains Regional Climate Center, www.hprcc.unl.edu.)

The US Drought Monitor shows abnormally dry to extreme drought conditions in many parts of the West. (The Drought Monitor is a collaborative product from the USDA, NOAA and National Drought Mitigation Center, www.droughtmonitor.unl.edu/monitor.html.)

Contact: Robert Webb (Robert.S.Webb@noaa.gov)

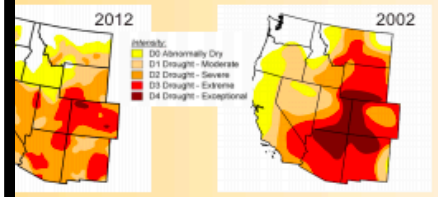
NOAA-WGA Regional Outlook

The 2012 Drought in Colorado, Utah and Wyoming

A July 2012 update from the Western Water Assessment and the National Integrated Drought Information System

…d winter of La Niña, drought conditions emerged midway through the 2012 water year, with low snowpacks melting …g a very dry and warm spring. Spring and early summer runoff over most of the region was well below average. …lar to 2002 and other benchmark drought years. Continued dry and hot conditions in June dried out vegetation and …e and intense wildfires in all three states, along with widespread rangeland, pasture, and dryland crop losses.

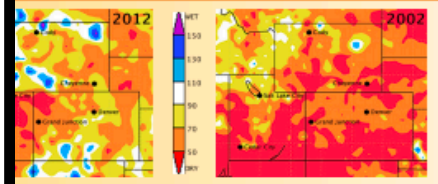
Drought Conditions as of early July



…onitor for July 10, 2012 (left) and July 9, 2002 (right) …droughtmonitor.unl.edu/monitor.html).

According to the July 10 US Drought Monitor, severe or worse drought conditions cover nearly all of Colorado, most of Utah, and about half of Wyoming. In early July 2002, conditions were generally worse than 2012 across the three-state region, except for north-central Colorado and far northwestern Utah. The severity of the drought classification (D1–D4) is based on hydro-meteorological variables such as precipitation, soil moisture, streamflow and temperature. Note that the Drought Monitor is now based on more detailed spatial input compared to 2002.

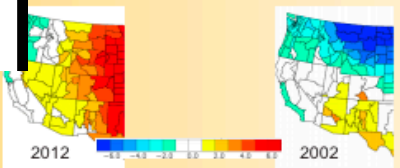
Water Year Precipitation through June



…rage (1995-2010) precipitation for the current water year to date, October …2 (left), with October 2001–June 2002 (right) for comparison. (Source: …nd SNOTEL data; Gary Bates, NOAA ESRL Physical Science Division)

For the water year to date (October 2011 through June 2012), a mixed first five months followed by an extremely dry March-June added up to dry conditions across all of the region, except for pockets in northern and southwest Wyoming, and southern Colorado. The driest areas, with less than 70% of average precipitation, included many of the key mountain headwaters in western and northern Colorado, and in Utah. But as dry as water year 2012 has been, 2002 was drier over the same period in nearly all parts of the region.

Spring and Early Summer Temperatures



March-May temperatures in 2012 (left) were 2° to 7° F above normal across the 3-state region, much warmer than the same period in 2002 (right). (Source: NOAA ESRL PSD Climate Analysis Branch, plotted from NOAA NCDC divisional data: http://www.esrl.noaa.gov/psd/data/usclimdivs/)

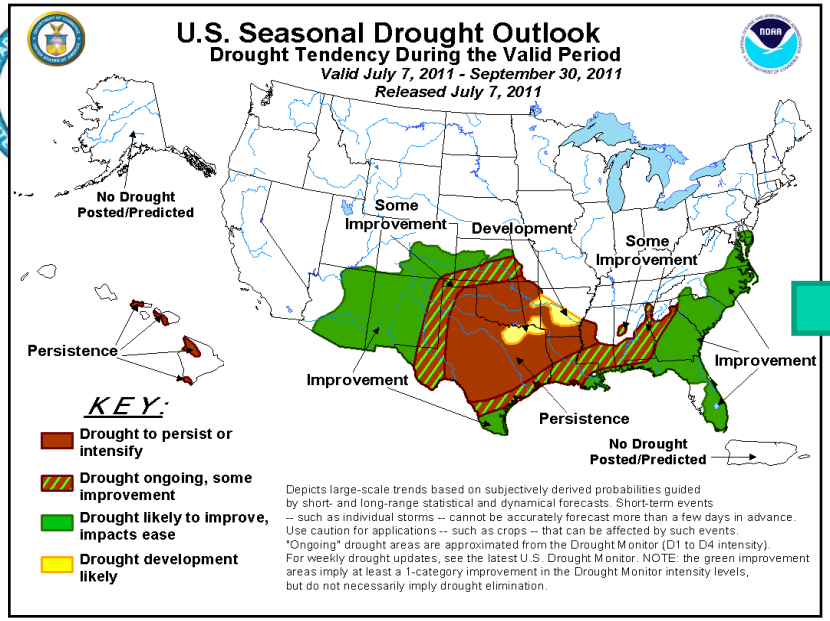
March-May 2012 was the 2nd warmest spring in Colorado in the past 118 years, the 3rd warmest in Wyoming and the 8th warmest in Utah. This extended warmth hastened the early meltout of the already-low snowpack, and caused excessive evapotranspiration from soils and vegetation. June continued the string of warm months, with temperatures 2°–8° F above average across the region. In eastern Colorado, there were many record daily highs in late June and a tie for all-time highest statewide temperature for Colorado (114° F in Las Animas on June 23rd).

For an expanded version of this overview, including additional graphics and text, see the Special Issue of the Western Water Assessment *Intermountain West Climate Summary* at wwa.colorado.edu/IWCS/2012_July.html

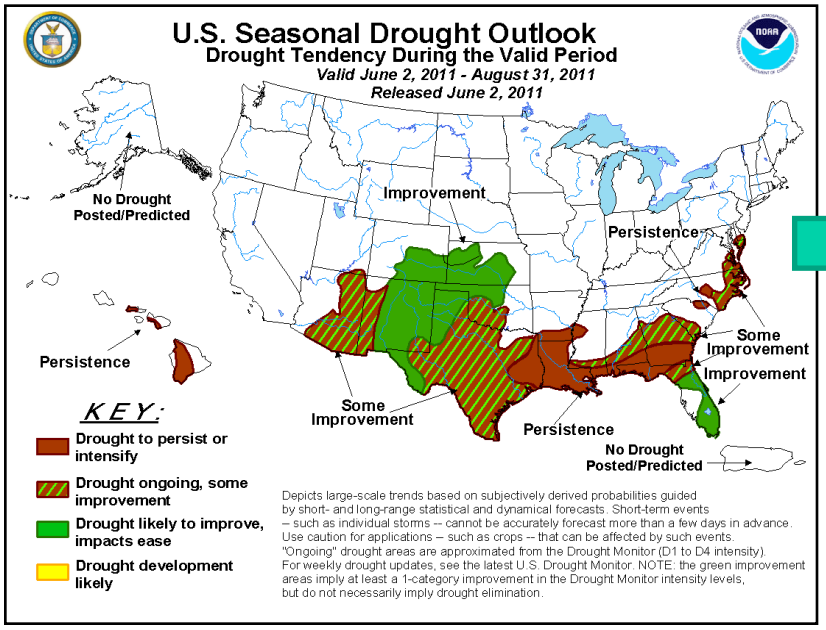
NIDIS-RISA Drought Status and Outlook

Extras

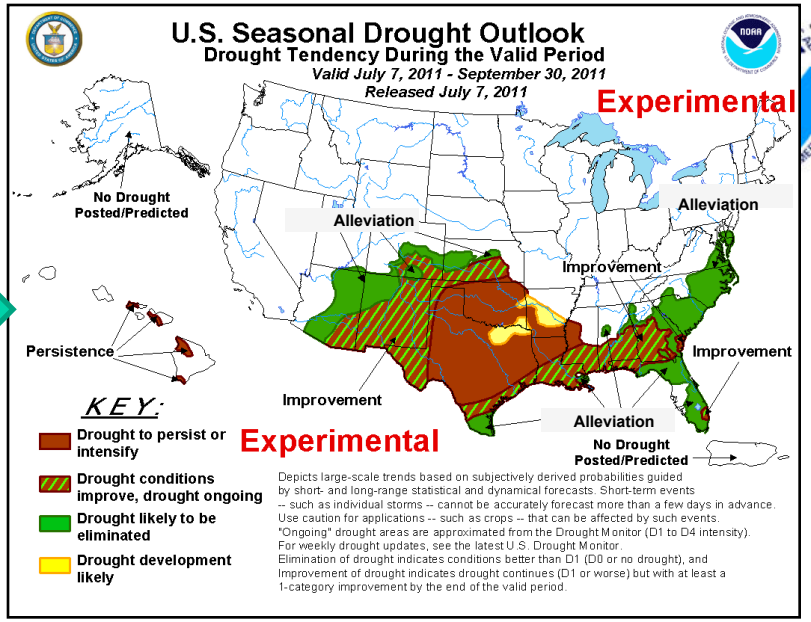
1. Proposed changes to the U.S. Seasonal drought outlooks.
2. Climate Modeling and Prediction Advances at NCEP
3. CPC Major Thrusts (FY13)
4. CPC Summary



Current USDO: Initial 3-Month (*Top*) & Updated 3-Month (*Below*)

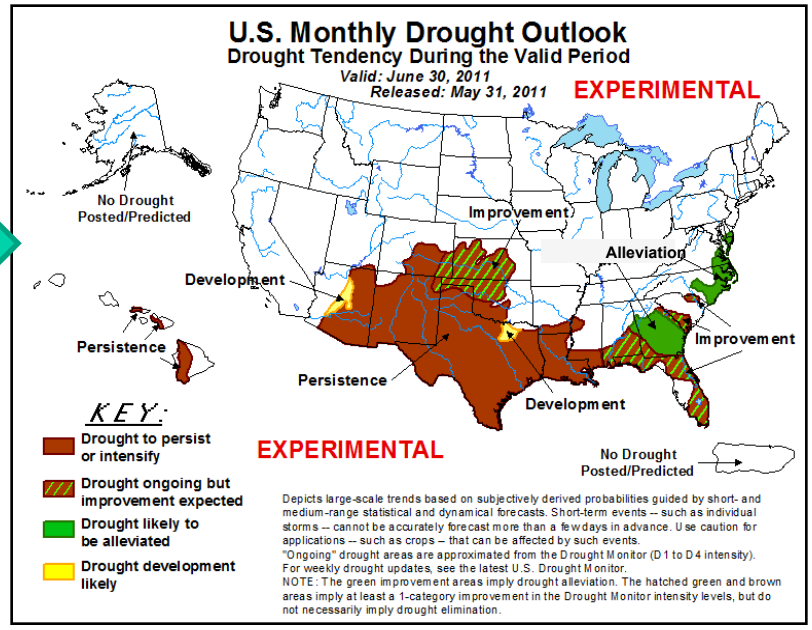


instead



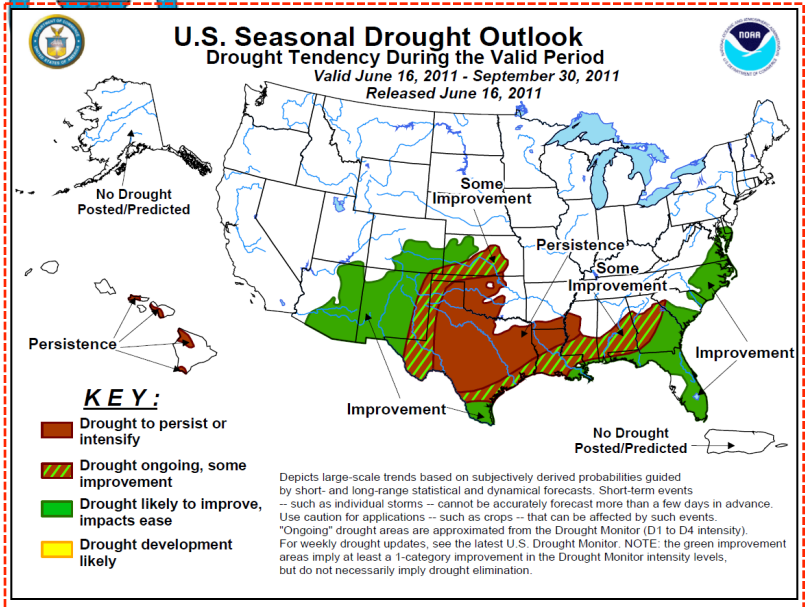
Proposed USDO: 3-Month (*Top*) & 1-Month (*Below*)

instead



Proposed Modifications to the U.S. Seasonal Drought Outlooks

By CPC USDO Authors: David Miskus, Brad Pugh, Adam Allgood, Rich Tinker, and Anthony Artusa



Initial JAS'11 USDO: Produced 3rd Thursday each Month

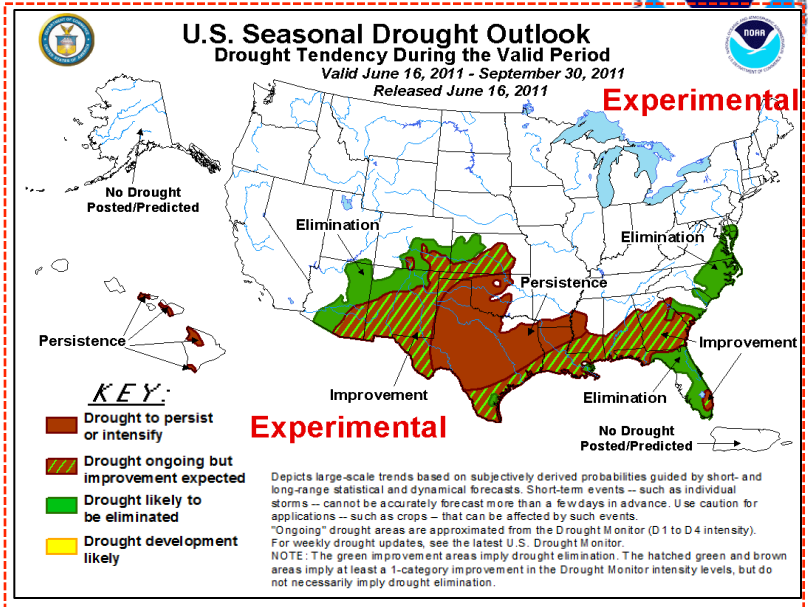
Created an **Elimination** category where Drought (≥D1) is forecast to improve to D0 or none at end of period;

Changed **Some Improvement** (a buffer zone between Improvement & Persistence; not scored) to **Improvement** where at least 1 category improvement is expected, but drought (≥D1) is expected to remain at end of period;

Development & **Persistence** remain the same;

Production Date remains the same;

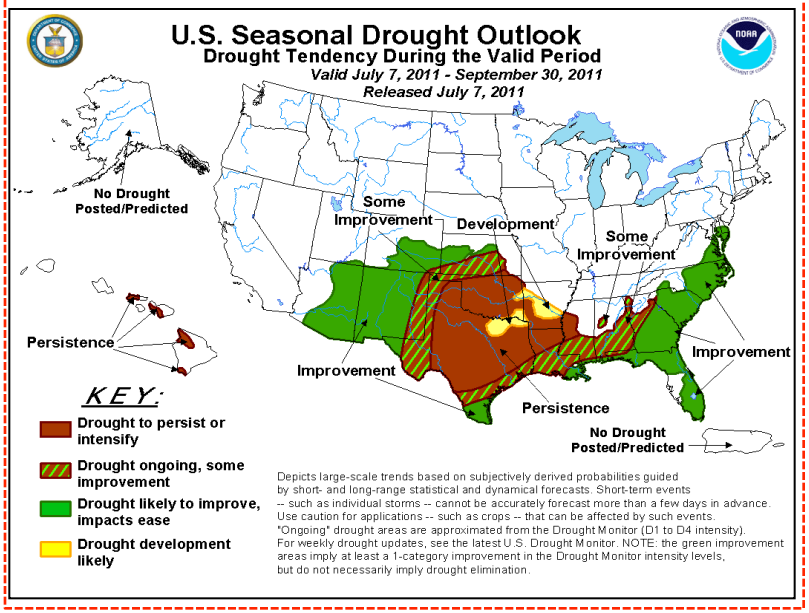
The proposed formats will **increase skill score coverage** by eliminating the currently unscored **Some Improvement** category;



Current Formats

MODIFICATIONS

Proposed Formats



Updated JAS'11 USDO: Produced 1st Thursday each Month

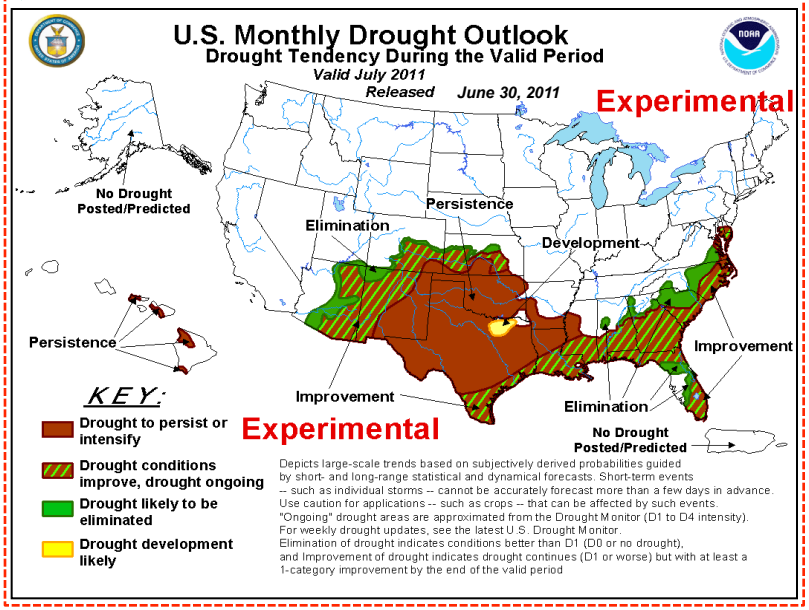
Replaced the Updated 3-Month USDO with an **Initial 1-Month USDO** since current updated 3-month USDO "forecast skills" mostly come from the updated 1-month CPC Outlooks and short- to medium-term forecasts. A 1-Month USDO is better suited to short-term (e.g. agricultural) applications;

Changed Production Date from 1st Thursday of Month to **Last Day of Previous Month**;

Created an **Elimination** category where Drought (≥D1) is forecast to improve to D0 or none at end of the month;

Changed **Some Improvement** (a buffer zone between Improvement & Persistence; not scored) to **Improvement** where at least 1 category improvement is expected, but drought (≥D1) is expected to remain at end of the month;

Development & **Persistence** remain the same;



Some Recent Climate Modeling and Prediction Advances at NCEP

Climate Forecast System **- NOAA's first dynamic, fully-coupled operational climate forecast model**

- **CFSv2 operational (Mar 2011)**
- **CFSv3 strategy with community (2012+)**

Climate Test Bed **- R2O and O2R**

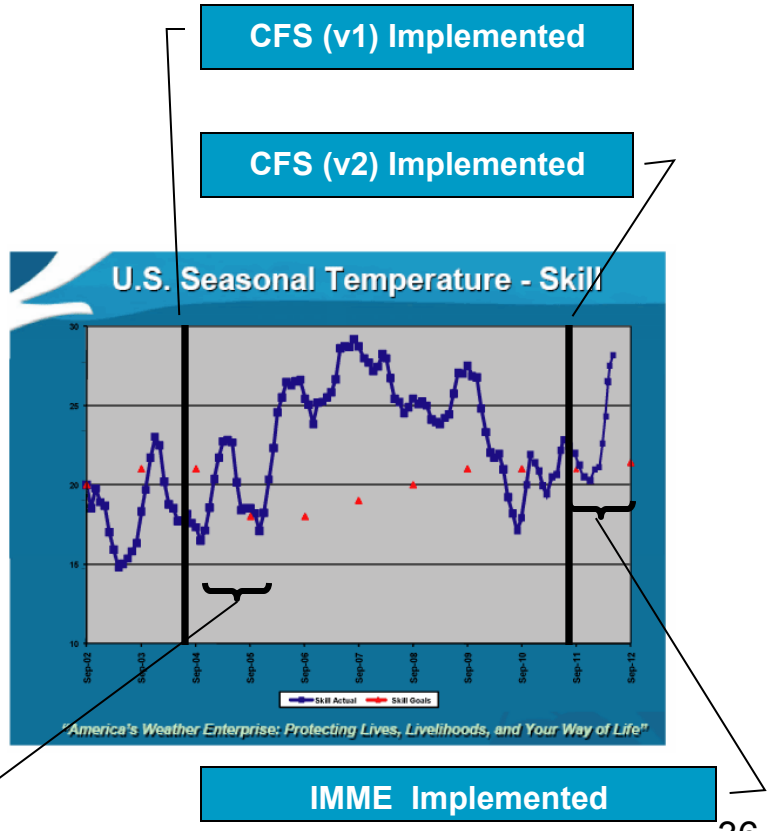
Science Priorities:

- **Climate Forecast System improvements**
- **Multi Model Ensembles (NMME)**
- **Climate forecast products**

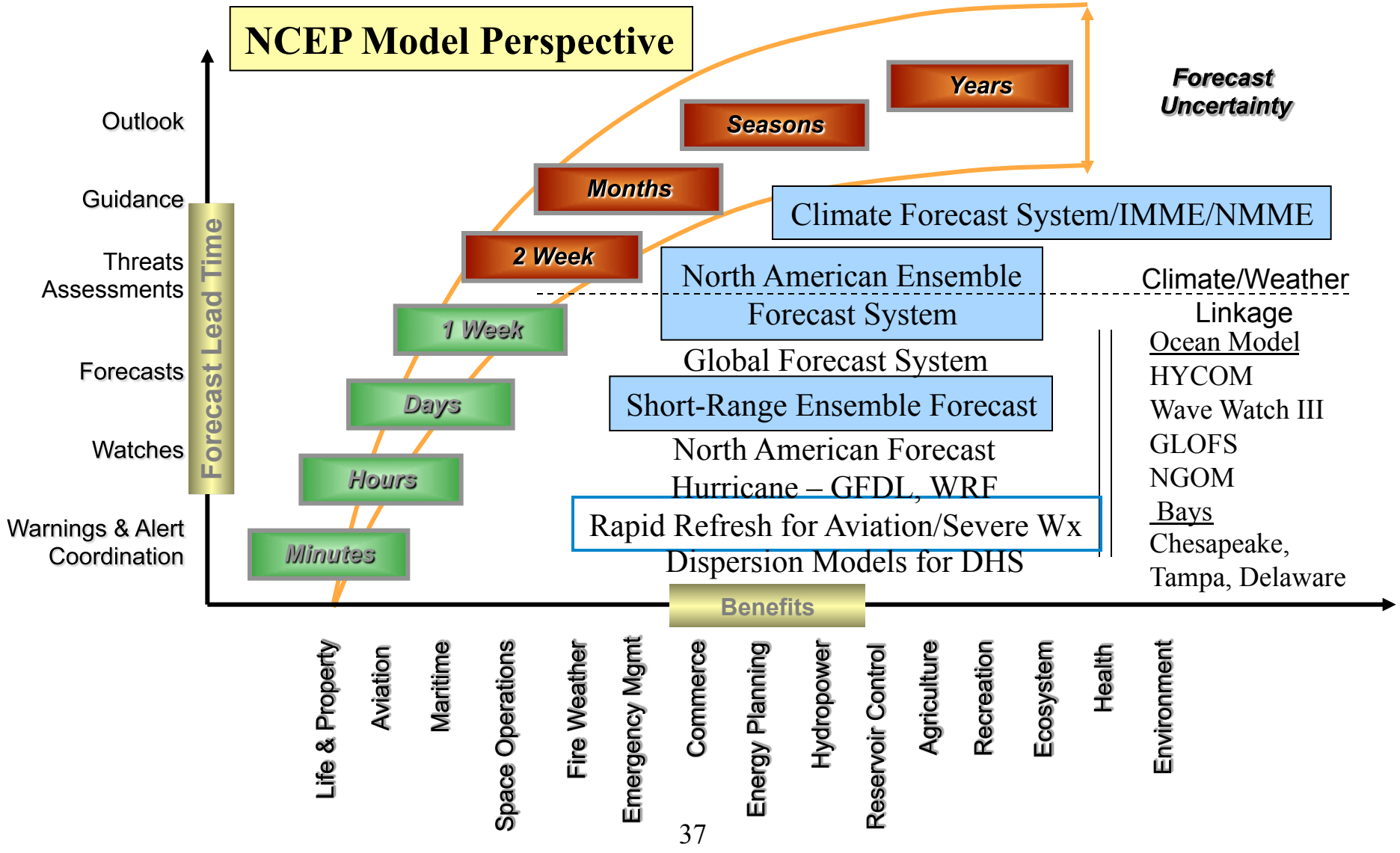
Agreements and Task Forces

- **CPO-NCEP MOU (2012)**
- **MAPP-CTB Execution Agreement (2012)**
- **Drought, Modeling Task Forces**

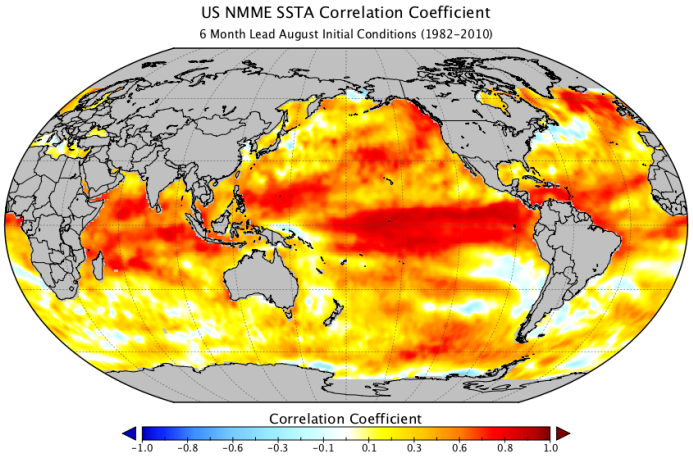
These advances have improved forecast skill (e.g CPC GPRA Measure)



MME Prediction Systems are Used Across Timescales at NCEP



International Multi-Model Ensemble

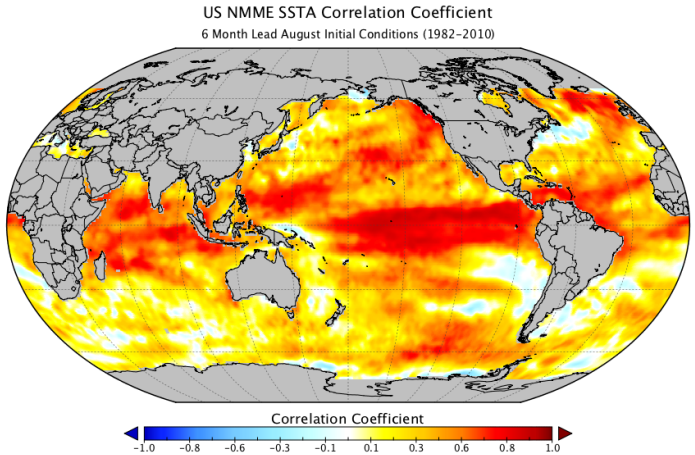


Participants

- EUROSIP (ECMWF, Meteo France, UKMO)
- NOAA (NCEP CFS)

- **Operational Products**
  - Monthly and seasonal mean sea surface temperature, precipitation and surface temperature for North America and for global domains and a plume diagram for Nino3.4 sea surface temperature.
- **Products producing maximum benefits**
  - In the US, the plume diagram and the North American surface temperature/precipitation
- **Future Products**
  - Skill maps for SST, precip and surface temp followed by new 'requests', such as wind-shear in support of the Atlantic Hurricane seasonal outlooks.

National Multi-Model Ensemble Experiment



Participants

- NCEP, GFDL, NCAR, NASA, IRI, COLA, U. Miami/RSMAS, U. Colorado/CIRES, Princeton
- Led by NOAA, but a truly interagency effort

- **Products**
  - Monthly and seasonal mean sea surface temperature, precipitation and surface temperature for North America and global domains, and plume diagram for Niño3.4 sea surface temperature.
- **Phase I**
  - Goal: Experiment with an MME "of opportunity" based on currently available national models and a basic design (Funded by CPO-MAPP)
  - Experimental Implementation at CPC (Aug 2011) – adheres to CPC Operational Schedule
- **Phase II**
  - Goal: A more "purposeful" MME Experiment with improved models, more fields, and an optimal experimental design to address key research questions.
    (Funded by CPO-MAPP with contributions from NSF, NASA and DOE).

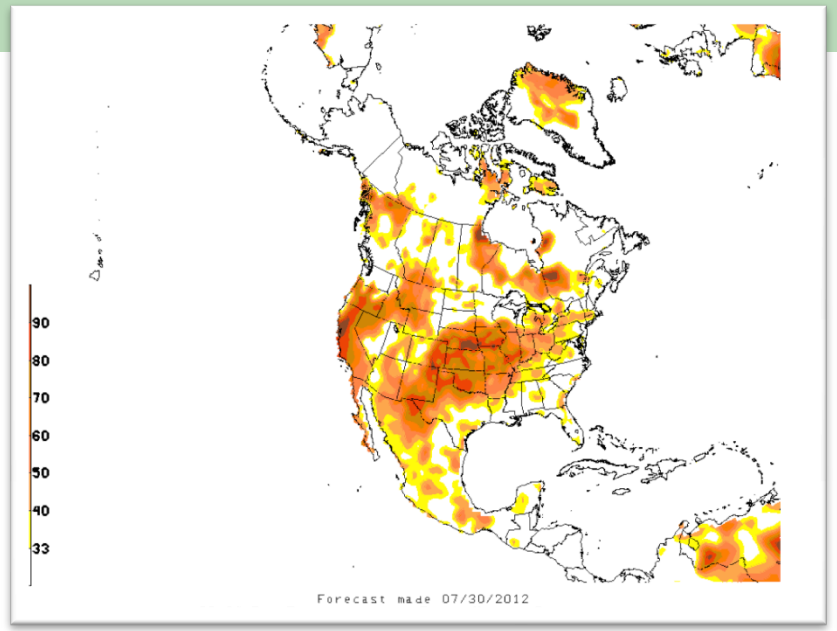
North American Ensemble Forecast System

- **Participants**
  - NCEP Global Ensemble Forecast System (GEFS)
  - Environment Canada Ensemble Prediction System (EPS)
  - Servicio Meteorológico Nacional (SMN, Mexican National Weather Service)

- **Products**
  - Probabilistic week-two temperature and precipitation for North America and global domains
  - Bias correction of many more variables
- **Initial Phase**
  - MME based on U.S. and Canadian national ensemble models – Incorporated at CPC into week-2 Operational Products
  - Correction and probability calibration to operational analyses using forecast verification
- **Next Phase**
  - Additional models (e.g. Fleet Numerical Meteorology and Oceanography Center)
  - Optimal calibration of forecasts using multi-decadal reforecast datasets – Experimental reforecast datasets available for GEFS and EPS models.
  - Experimental extended forecasts into week-3 and week-4

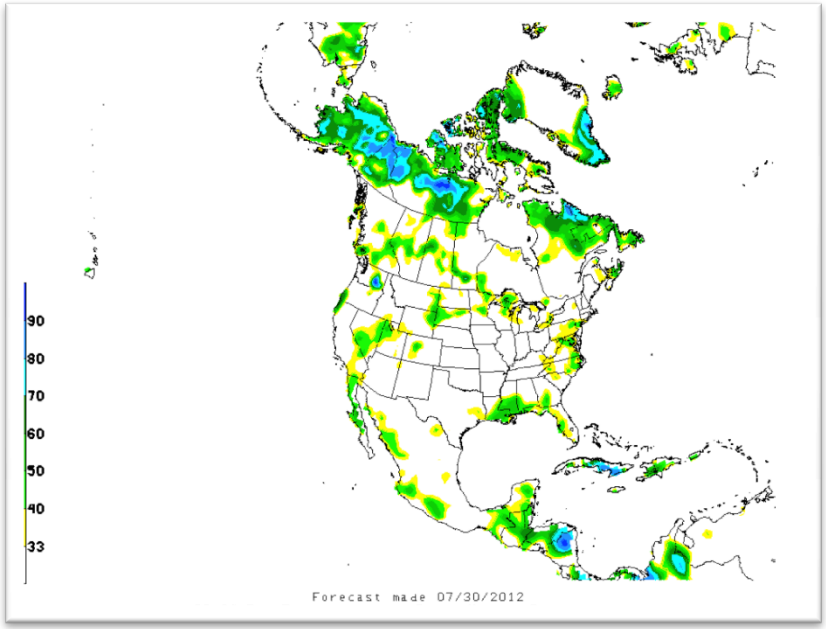
Intraseasonal Climate Outlooks

- North American Forecast Systems (NAEFS)
- MME of Canadian and NCEP Global Ensembles



Probability of Below Average Precipitation

Week-2 Forecast Valid 08/07/2012-08/13/2012



Probability of Above Average Precipitation

Week-2 Forecast Valid 08/07/2012-08/13/2012

Intraseasonal Climate Outlooks

- North American Forecast Systems (NAEFS)
- MME of Canadian and NCEP Global Ensembles
- Verification

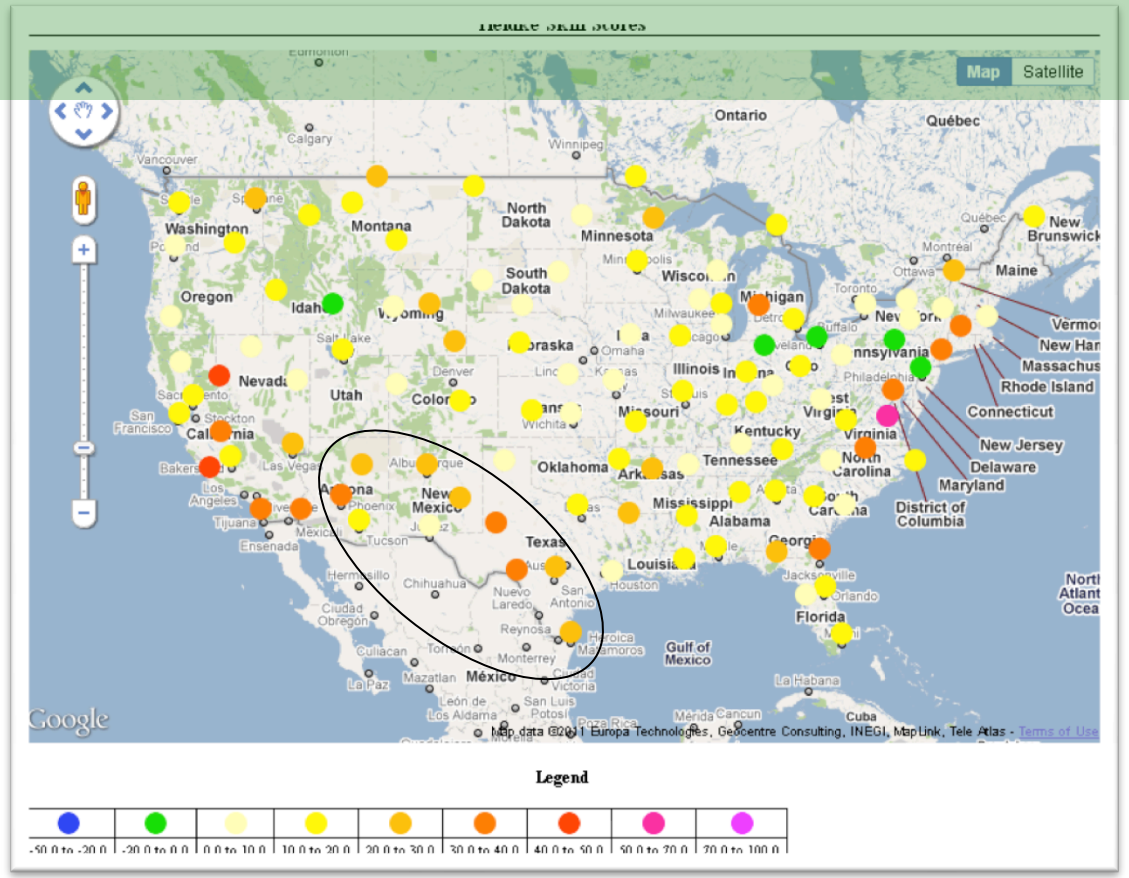
Week-2 Precipitation

Heidke Skill Scores by Station

Yellow – more skillful than climatology

Orange – 20-40% improvement

in hit rate over climatology



Intraseasonal Climate Outlooks

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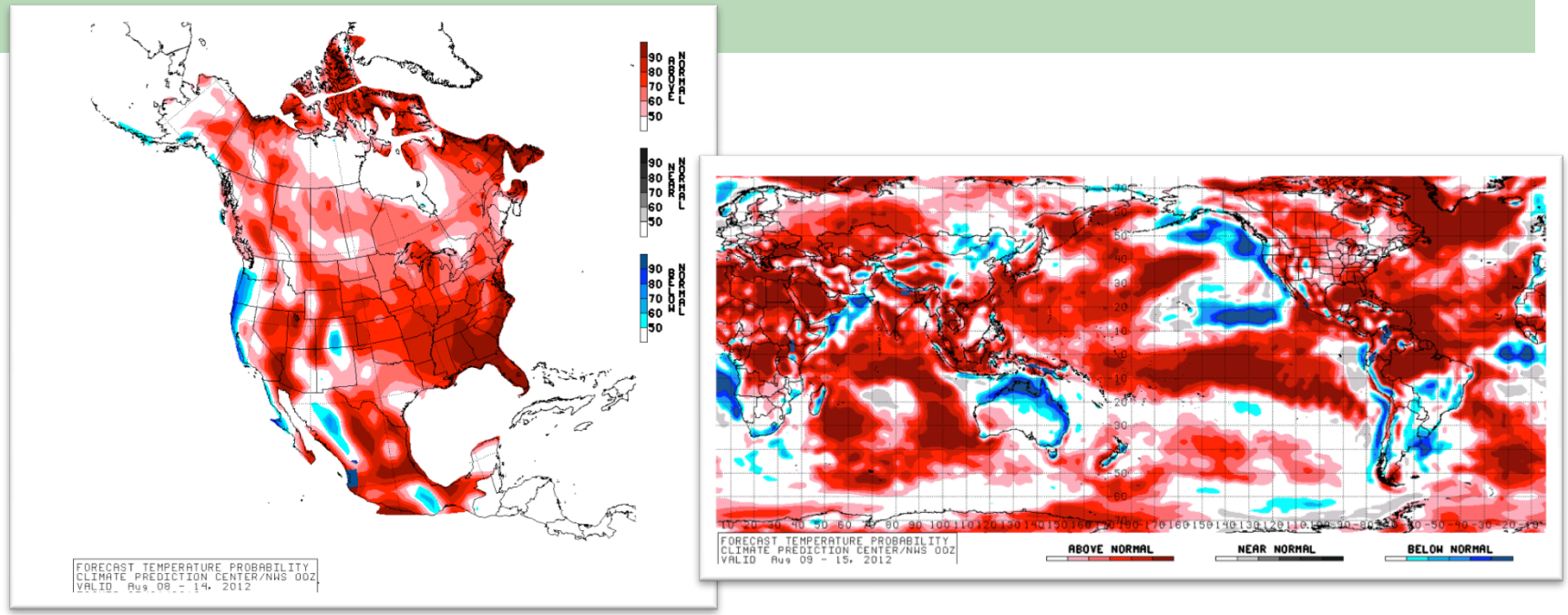

Probability of Above, Near or Below Normal Temperature

Week-2 Forecast Valid 08/07/2012-08/13/2012

CPC Progress Towards NCEP Strategic Planning Goals

FY13 Major Thrust Areas

— Support NOAA Climate Services

- Provide Climate Products & Services for NGSP Societal Challenges (NIDIS, Weather & Climate Extremes, Coastal Innundation)
- Support AA Climate Goal Board and Executive Working Groups
- Support Climate.gov
- Lead National Climate Predictions and Projections Platform

— Accelerate advances in climate modeling and prediction

- NCEP Climate Modeling Team focused on CFS
- Develop strategy for CFSv3 with community
- Advance Multi-Model Ensembles (IMME and NMME)
- Develop NOAA-wide strategy for climate reanalysis

CPC Progress Towards NCEP Strategic Planning Goals

FY13 Major Thrust Areas

- Work across NOAA and with other organizations on expanded responsibilities for climate
  - Enhance collaborative forecast process with NCEP Service Centers (Wx-Cx linkage)
  - Implement Agreements (i.e. CPO-NCEP MOU; MAPP-CTB EA; etc.)
  - Enhance NCEP International Desks (e.g. trainer capacity)
  - Link NCEP Visiting Scientists Program to CTB
  - Develop CPC Strategic Plan with stakeholder community
- Identify and fill gaps in the "seamless suite" of forecast products
  - Continue research to identify sources of predictability & prediction skill in CFS, NMME, etc.
  - Transition new tools to operations and retire outdated ones
  - Implement comprehensive verification system for all CPC outlooks
  - New skill metric that combines extended range & seasonal outlooks (progress and value)

Summary

Climate Prediction Center

- **Delivers a suite of "operational" climate prediction, monitoring, and assessment products**
- **Accelerates advances in climate prediction and fills gaps in the "seamless suite" of climate products**
- **Works across NOAA and with other organizations on expanded responsibilities for climate; interdisciplinary approaches are the key to success**
- **Plays a unique and critical role in NOAA climate services**